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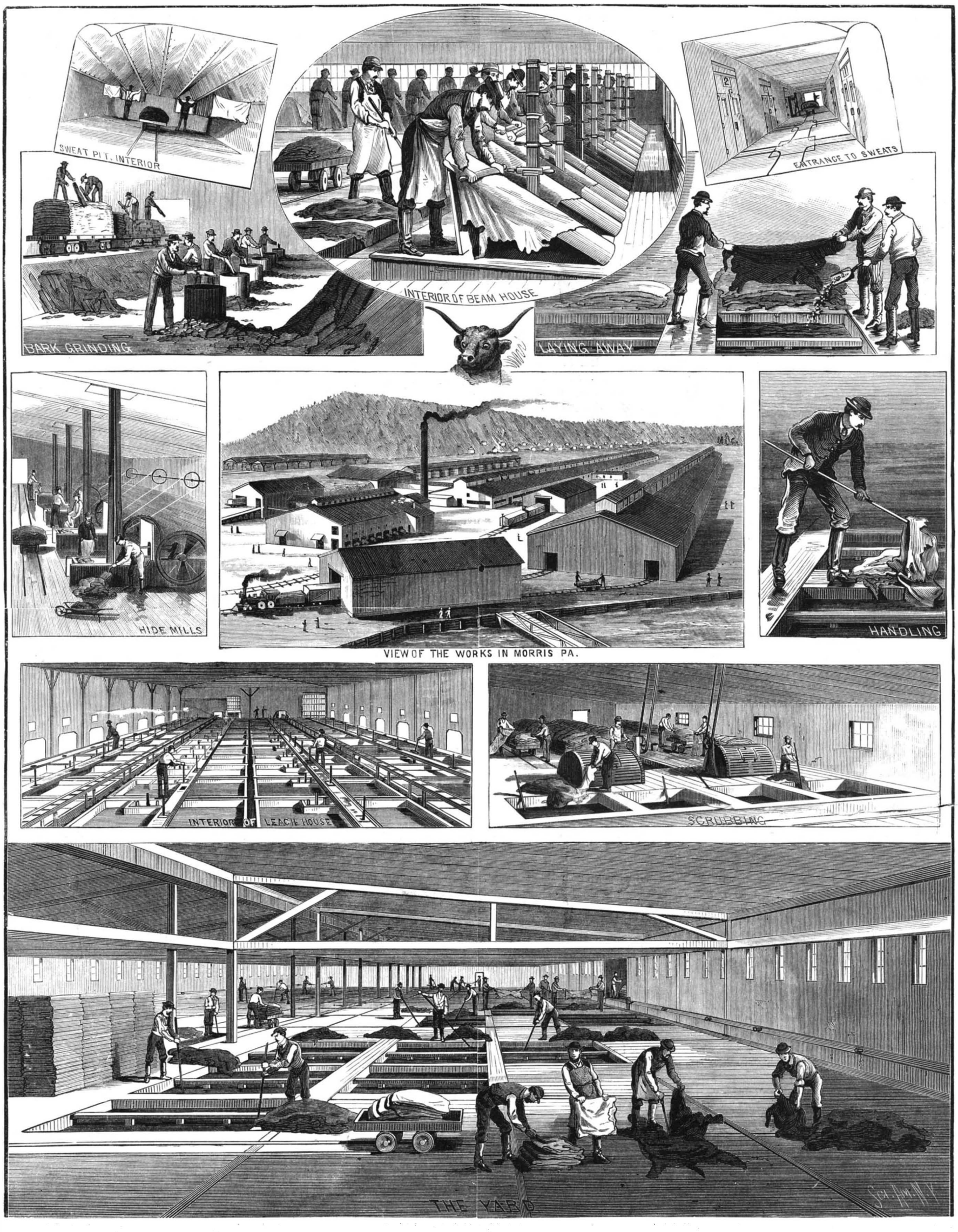


**THE MANUFACTURE OF HEMLOCK SOLE LEATHER.—"BRUNSWICK" TANNERY OF HOYT BROTHERS NEW YORK.**—[See page 35.]

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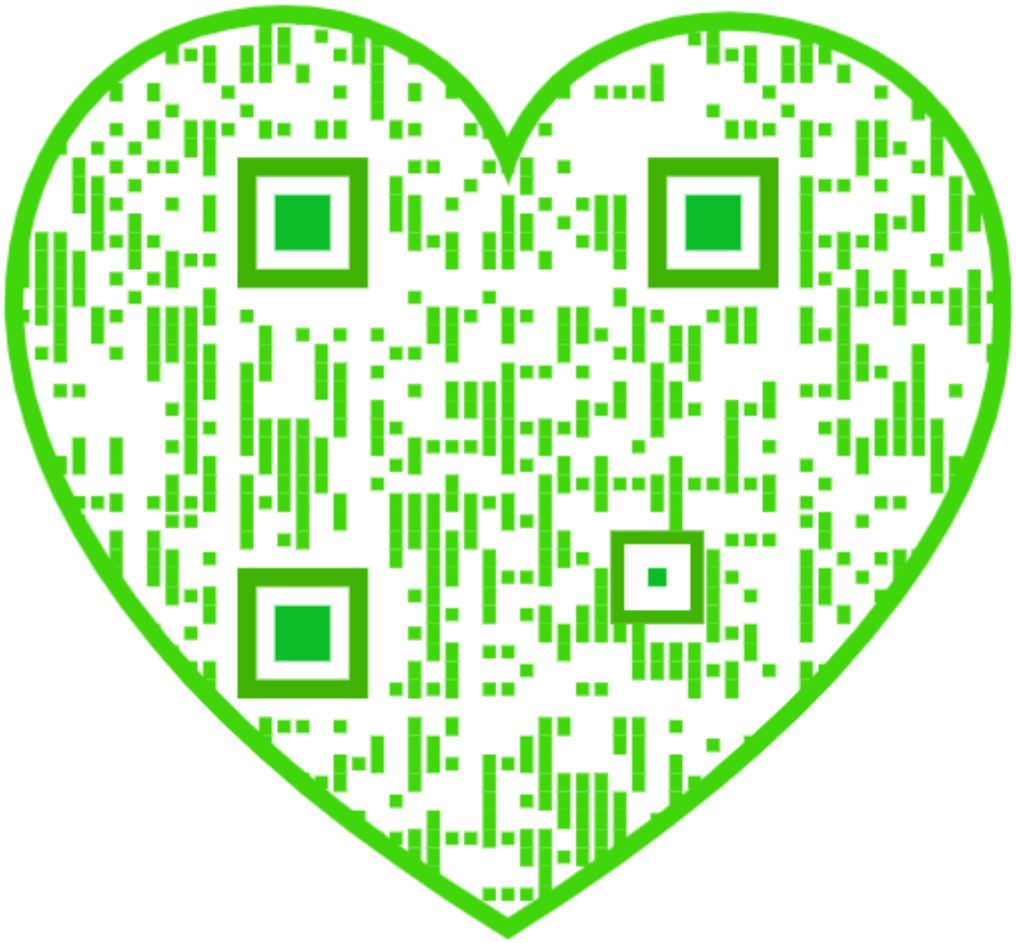

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**Contents.**

(Illustrated articles are marked with an asterisk.)


Accident, electric light, fatal.... 37
Acetate of soda stove*..... 40
American industries*.....31, 35
Aqua ammoniæ, explosion of..... 37
Arctic colony, American, first..... 39
Arctic temperatures..... 39
Areas of U. S. and territories. ... 41
Artificial port wine ..... 42
Assembly chamber at Albany..... 40
Automatic pencil, new*..... 38
Boiler experiment, Mr. Lawson's. 40
Bridge, Brooklyn, weight of..... 33
Bridge, notable, a ..... 37
Brooklyn Bridge, weight of..... 33
Capitol, the new, at Albany..... 40
Cave, Leitchfield, about the..... 41
Chemical manufactures..... 36
Circular sawmill, improved*..... 38
City of Puebla, the..... 33
Cliff dwellers, a great city of..... 41
Coal, space occupied by ..... 37
Colony, Arctic, American..... 39
Corn crusher wanted. ..... 39
Deer, revolution in a herd of..... 38
Dogs, intelligence of ..... 40
Eggs, trout, California..... 40
Electrical stature alarm ..... 34
Electric light accident, fatal..... 37
Engineering inventions..... 40
Engines, gas, use of, etc ..... 32
Explosion of aqua ammoniæ ..... 37
Feeder, furnace, improved*..... 34
Fractures, plaster of Paris in..... 37
Furnace feeder, improved*..... 34
Gas engines, use of, etc..... 32
Gold and silver in the sub-treas'y 41
Gold quartz stamper, improved* 39
Gravitation ..... 42
Hemlock sole leather, tanning* 31, 35
Industries, American* ..... 31, 35
Industry, leather, the..... 32
Intelligence of dogs..... 40
Inventions, engineering..... 40
Inventions, mechanical. ..... 38
Inventions, new..... 41
Inventions, railway, wanted..... 33
Inventions, recent..... 41
Iodine reactions ..... 42
Leather industry, the..... 32
Leather tanning, hemlock*.... 31, 35
Leitchfield cave, about the..... 41
Lungs, capacities of..... 34
Malarial organisms in the blood.. 37
Malt, an extract of..... 42
Materials, strength of..... 33
Mechanical inventions..... 38
Mirrors, telescopic, silvering..... 37
Morning work..... 37
Notes and queries..... 43
Paint, phosphorescent .. ..... 34
Pencil, automatic, new*..... 38
Phosphorescent paint..... 34
Photo-engraving process..... 34
Pigeon show, big..... 33
Plaster of Paris in fractures..... 37
Port wine, artificial..... 42
Quartz stamper, improved*..... 39
Railroad spike, improved*..... 34
Railway inventions wanted ..... 33
Sash-cord guide, improved* ..... 34
Sawmill, circular, improved*..... 38
Science in the navy ..... 33
Sea serpent, Marlboro.. ..... 38
Ship, sailing, steel, large ..... 32
Silvering telescopic mirrors..... 37
Spiders, how they fly..... 42
Spike, railroad, improved*..... 34
Stature alarm, electrical..... 34
Stove, acetate of soda*..... 40
Tannery, Brunswick*..... 31, 35
Telescopic mirrors, silvering..... 37
Temperatures, arctic ..... 39
Time service, uniform proposed. 39
Trout eggs, California..... 40


TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
**No. 316,**
**For the Week ending January 21, 1882.**

Price 10 cents. For sale by all newsdealers.


PAGE

I. ENGINEERING AND MECHANICS.—The New War Ship of the British Navy, the Inflexible.—13 figures.—Views fore and aft, showing methods of launching and firing Whitehead and submerged torpedoes.—Views in and from turrets.—Torpedo room.—Engine room.—Captain's cabin.—The 80-ton gun.—Nordenfelt gun.—Birdseye view of the Inflexible.—The Dnilio, etc..... 5031
The Economy of Gas Engines. By Prof. W. E. AYRTON ..... 5034
Bessemer Steel Manufacture. By W. D. ALLEN.—On the use of [illegible] ..... 5034
Locomotive Distilling Apparatus. 1 figure..... 5038

II. TECHNOLOGY AND CHEMISTRY.—Researches on Perchloric Acid. By M. BERTHELOT..... 5038
Reaction for Gallic Acid..... 5038
On the Estimation of Dried Residue from Wines. By M. L. DE SAINT MARTIN..... 5039
Crystallization..... 5039
Lubricants.—Many patented and not patented compositions for lubrication..... 5039
Butter Coloring.—Rovick's compound.—Bogart's compound.—Dake's coloring ..... 5040
The Prevention of Nuisance from Gas Purifiers..... 5040
Japanning and Japans.—Several recipes ..... 5040
New Researches on Pharmaceutical Sirups.—A new method of preserving sirups ..... 5040
The Cup that Cheers..... 5040
Skunk Perfume as an Anæsthetic..... 5041
How Fertilizers are Made at Atlanta, Georgia..... 5041

III. NATURAL HISTORY, ETC.—Method of Ascertaining the Age of Eggs..... 5036
The Tail in the Human Embryo ..... 5041
A New Imported Enemy to Clover..... 5041
Natural and Industrial History of the White Pine in Michigan... 5041
Tea..... 5046
Fur-bearing Animals of Maine..... 5046

IV. ARCHÆOLOGY, ETC.—The Ancient Palaces of Uxmal and Mayapan, Mexico. 4 figures. Niche in which was found the Statue of Kinich-Kalhuio, wife of Chaacmal (Facade of the Governor's House. Uxmal.)—Facade of the Governor's House, Uxmal.—Wing of the Palace of the Nuns.—Principal Entrance to Governor's House, Uxmal..... 5042
Texas Painted Caves..... 5042
Recent Discoveries in Babylonia..... 5044

V. GEOLOGY, ETC.—Geological Facts Recently Observed in Montana, Idaho, Utah, and Colorado ..... 5044
Geology of the Palisades of the Hudson. By A. E. HOPPOCK.... 5045
Niagara River. Its cañon, its depths, and wear..... 5045
Recent Extinction of the Mastodon..... 5046

VI. ELECTRICITY, ETC.—Electrical Ball Finding..... 5035
Telegraph Codes and Ciphers..... 5035
The Microphone in Observatories. By L. NEISTEN..... 5035
Limits of Electrolysis..... 5040

VII. SHORT-HAND.—A Practical Short-hand for Everyday Use. By JAMES RICHARDSON. Need of easier mode of writing.—Requisites for perfect writing.—What an alphabet should represent.—Elements of English speech.—Material available for a scientific alphabet.—Alphabet of Neophonography.—How to read neophonography.—How to write neophonography.—Neostenography.—Illustrations. ..... 5036

VIII. ASTRONOMY.—Finding the Latitude of a Place by the Stars... 5042


## THE USE AND ECONOMY OF GAS ENGINES.

A secondary, but important and instructive feature of the recent exhibition of electricity in Paris, was a notable display of gas engines, a type of engines in increasing demand for driving dynamo-electric machinery.

This is not the only way in which the use of electricity for illumination tends to increase the consumption of gas, thus making those apparent rivals, gas and electricity, in reality mutually helpful allies. One of the first effects of the introduction of electric light is to accustom the public to a much greater brightness of artificial illumination than had before been thought necessary. Where one burner was formerly sufficient two or three are now required, so that the demand for gas is directly increased by the development of electric lighting. And even though electric lights should, in the end, very largely displace gas lights, the employment of gas engines for running the machinery of electric lighting is likely to create a larger demand for gas than now obtains; and the use of gas as a source of power cannot well be stopped with the running of dynamo-electric machines. The increasing attention drawn to the efficiency and economy of gas engines promises not only a very large increase in the commercial manufacture of gas, but as marked a change in the use of coal as a source of power.

It is well known that as coal is burned for the generation of steam power, there are two inevitable sources of loss, and great loss. So much of the energy developed by combustion is used up in converting the water into steam that a theoretically perfect engine could not utilize more than one-fifth the total energy of the coal. In practice the efficiency of the best large engines is only half that of a theoretically perfect engine, or about one-tenth the power of the coal. With small engines and ordinary furnaces the efficiency falls much lower.

The ordinary furnace, moreover, is ill adapted for the economical execution of the two distinct processes which go on in them, namely, the conversion of coal into gas, and the simultaneous combustion of the gas as fuel. When these processes are separated, and the gas properly made and economically burned, it may be possible to approach somewhat more nearly the theoretical efficiency of the perfect steam engine; but, at the best, improvement in this direction promises less in the way of increased economy than is secured by the direct development of power in gas engines by the burning of gas explosively.

As shown by Prof. Ayrton, in his address at the Electrical Exhibition (SCIENTIFIC AMERICAN SUPPLEMENT, No. 316), the theoretical efficiency of a gas engine should be about 75 per cent, if loss of heat by conduction, radiation, convection, and friction could be prevented; this against an efficiency of 20 per cent with a theoretically perfect steam engine. Prof. Ayrton goes on to show, mathematically, from the laws of thermo-dynamics, that the *practical* efficiency of a gas engine should exceed 50 per cent, or five times that of a steam engine.

Touching the relative economy of working the two types of engines in practice no entirely satisfactory comparison can be made, since no very large gas engines have been constructed, and small gas engines are not so disadvantageous in comparison with large ones as small steam engines are. Professor Ayrton's tables show, however, the comparative working cost of a portable steam engine and an Otto gas engine, each of 30 horse power, for 300 working days, the one using (bituminous) coal at $3.75 a ton, the other coal gas at 75 cents a thousand cubic feet. The results show that the cost of running the gas engine was considerably less than that of the steam engine, notwithstanding the higher cost of the fuel.

A much greater working economy was developed when the gas engine was run with a cheap gas made by the Dowson process. In this case the gas for 300 days' running was made from 39 tons of anthracite worth $5 a ton. To run the steam engine 300 days required (including 10 tons of coal consumed before and after work) 227 tons of coal. Taking all the items of expense into the calculation (labor, repairs, interest, etc., the coal being reckoned at $3.75 a ton), Professor Ayrton found the economy in working cost in favor of the gas engine using Dowson gas, compared with steam, to be 47½ per cent. The economy in working cost in favor of Dowson gas, compared with coal gas, was 45½ per cent. The saving in weight of coal in favor of Dowson gas and gas engine, compared with steam engine requiring 6 pounds of coal per indicated horse power, was as 217 tons to 39 tons, or (as he figures it) 88 per cent.

Obviously a liberal deduction must be made from these percentages to get a just comparison of the weights of coal required where the steam is generated under fairly economical conditions, the allowance of six pounds of coal per horse power per hour being two or three times what is required with good stationary or marine engines. On the other hand, to adapt the comparison to this market there would be a decided gain in favor of gas (by the Dowson process) owing to the relatively greater cheapness of anthracite in this country. The other factors of Professor Ayrton's calculations being the same, the economy in favor of Dowson gas, made from anthracite at the price of such coal here, would be over fifty per cent. In case the gas were manufactured at the coal mine (where coal is cheap and finely broken coal suitable for gas making is a nuisance) and the gas piped to the point of consumption as is now contemplated, the relative economy of gas engines would be still greater. In any case the problems raised and economics promised by the extension of this method of generating power are well worthy of the attention of mechanical engineers and inventors.

The saving in bulk and weight of coal, in case gas engines should prove to be suitable for marine use, is a matter of great importance where space and floating capacity are so valuable as they are at sea; and the indications are that the apparatus required for manufacturing gas to be used explosively would be much lighter and less bulky than the furnaces and boilers needed for generating steam by the combustion of two or three times as much coal as would suffice for a gas engine of equal power.

## OUR LEATHER INDUSTRY.

The illustrated article upon the sole leather manufacture we this week publish—forming No. 81 in our series on American industries—can hardly fail to be of general interest in this country, both in and out of the trade, while it is sure to receive marked consideration in many other parts of the world, where our leather and the processes of manufacture have been conspicuously misrepresented ever since we began to be large exporters in this line, about ten years ago. In 1870 our total exports of leather were but $111,077; in 1876 they reached the sum of $9,343,560. Their aggregate value has fallen off a little since then, because prices are lower, but there has been an actual increase in the quantity of goods shipped, and the market for American sole leather in England, in the north of Europe, and on the Mediterranean, is now as well established as is the demand for our grain and provisions. Germany, in answer to the urgent appeals of her tanners, placed heavy duties on our sole leather in 1878. The tanners there said they would all be ruined if this were not done, and held conventions in many places, finally compelling the Reichstag to impose the duties; but a good deal of our leather still goes there nevertheless, and our trade with the rest of the continent has increased more than enough to make up for the small decrease in the German shipments. In France the duty has always been practically prohibitive, but in both France and Germany they would be glad to allow our sole leather to enter free of duty if we would but put them on the same basis in regard to their trade here in finished calf and kid skins.

In these goods, though our own productions for actual wear will compare favorably with those imported, much of the finest stock used is made in France and Germany, our receipts thereof, for the past ten years, having averaged about $5,000,000 a year, while for the ten months to the first of last November they were $5,874,505. Such goods require nice selections and careful assorting in the raw stock, more thorough working by hand, and more particular attention in many minor details than have been found could be done with profit here, notwithstanding the duty. They require but little bark to tan, and a great deal of labor in finishing, conditions which are practically reversed in the sole leather manufacture.

Whether or not we regard tanning as a distinctively chemical process, it is conceded that the value of all sole leather is primarily dependent upon the permanence of the combination of tannin with the gelatin of the hide. With no other tanning agents yet discovered can so positive and fixed a union be effected as is possible with the tanning solutions obtained from oak and hemlock bark. These materials are as yet cheap and abundant here, and will be so for at least a generation or two to come, from the supplies afforded by our virgin forests, while in Europe similar tanning agents are to be had only in limited supply, at four to five times the cost. This explains why we have now a large and steady trade in the export of hemlock sole leather. We did not do much in this line for many years after we commenced tanning with hemlock bark, principally because of foreign prejudice against the red color of the leather made with it, English tanners claiming that it was not tanned, but only colored raw hide. Now, however, they appreciate its excellent qualities, its capabilities for resisting water and withstanding wear by attrition, in the soles of boots and shoes, as quite equal to those of the best English sole leather, and greatly superior to the leather of their "mixed" tannages, or the generally poor sole leather made on the continent of Europe. The English boot and shoe manufacturers are now, in consequence, as steady customers for our hemlock sole leather as are all the large manufacturers of standard grades of work in our own country This red sole leather goes into the bottoms of nearly all the boots and shoes they make for export to all quarters of the world, so that it is probable this one product of American industry finds in this way a wider market than anything else we make in every quarter of the globe. The strong prejudice which existed against it for many years is being everywhere overcome by a better acquaintance with its actual good wearing qualities; and the description we elsewhere give of one of the great tanneries where such leather is made—the largest sole leather tannery in the world—cannot fail to aid materially in extending sound practical ideas in relation thereto.

### A Large Steel Sailing Ship.

What is described as the largest steel sailing ship afloat was lately launched at Belfast, Ireland. It registers 2,220 tons, and has been named the Garfield. It will be employed in the Australian and California trade by the managers of the White Star Line.

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## RAILWAY INVENTIONS WANTED.

In this age of progress, when anything new is wanted, an appeal to the inventors usually brings forth the desired improvement. Give these men of brains an understanding of what is wanted, and if it is within the range of possibilities it will be brought to the front in due time. It rarely happens, however, that the first efforts of the inventor to produce some needed improvement is successful in every respect, although, in the main, they may give tolerable satisfaction. But American inventors and mechanics are satisfied with nothing short of perfection, and they never rest from their labors in any field until the ground is thoroughly worked over,

To say that a thing *is good* does not satisfy the average American; *it must be made better, absolutely perfect*, before he is satisfied. It sometimes happens, however, that a new device or discovery "fills the bill" when it is first brought out, but the conditions and circumstances under which it is used meet with a radical change, which necessitates an improvement or improvements to keep pace with the requirements in each particular case. As instances, we may mention the hand brake of forty years ago. With a speed of ten or fifteen miles an hour these brakes were satisfactory, but with our present velocities of a mile in 47 seconds they would be worthless; but as velocities of trains have increased, brakes and other railway appliances have been improved to meet the requirements in a great measure. Also, lubricants, years ago, were so prepared as to do tolerable service with the light trains, low rates of speed, and short runs of that period. Of course we had "hot boxes" in those days, but the journal bearings were imperfect and frequent heating might reasonably be expected. But heavier loads, higher velocities, and longer runs called for better lubricants, more efficient lubricating devices, and antifriction journal boxes, all of which have been forthcoming.

These have been improved to a wonderful extent, but there is yet room for improvement in all lubricants and antifriction devices and compounds. It is true that some remarkable performances are on record of long runs under high velocities with no warming up from friction. But notwithstanding the degree of perfection to which all the details of lubrication have been brought, there is a constant fear of hot boxes when there is extra service to perform. This, together with the fact that hot journals are not infrequent, may be accepted as proof that *perfection* has not yet been reached in the premises.

With the most approved apparatus now coming into use for taking fuel and water without scarcely slacking speed, the only thing that worries the engineer, on a long run, is the constant fear that "something will get hot." Here all his anxiety is centered, and the care with which he examines every part of his machine when she has been brought to a stand is evidence of a lack of that entire confidence that he would enjoy if he were assured beyond a shadow of a doubt that his lubrication was perfect. It would, of course, be extravagant to assert that any lubricant or lubricating device will ever be brought to that degree of perfection that a hot journal would never be looked for at the end of a long run, but to say that a great deal of trouble and anxiety, delays and accidents may be prevented by improvements in lubricants and lubricating devices is only to state facts. Some of the most horrible collisions on record were caused by running into trains that had stopped to cool hot journals. The want of perfect lubrication adds to the cost of transportation and destroys machinery, and here is a profitable field for the inventor; not only to improve the lubricating material but the mechanical devices connected therewith.

The first thing is to produce a pure lubricant, free from acids and all deleterious substances. The next is mechanical devices for storing and delivering the lubricant in proper quantities at the proper time and place. Some manufacturers of lubricating oils have very nearly met the first mentioned requisite, but after a time rascally adulterations find their way into the purest oils and there is trouble. This opens a field for the chemist. Every consumer of lubricating oils should be provided with some ready means of detecting adulterations. An agent calls on a large consumer with pure samples, and the first order is filled with a fair article. This begets confidence, and then comes inferior goods. Let the chemists bring forward their "ready and reliable oil tests," adapted to the use of purchasing agents, railway storekeepers, and others, and they will no doubt be substantially rewarded.

Mechanical tests of the relative merits of various brands of oils have been made by Prof. Thurston and others, which is very well so far as it goes, but these tests only serve to indicate which is the most durable and economical oil under test. This would, of course, be a valuable aid in selecting oils, providing the stock ordered was sure to be as good as the sample experimented with. But as this is rarely the case some reliable test should be applied to the contents of original packages to prevent imposition and fraud.

The next, or mechanical department (so to speak) of lubrication, has been pretty thoroughly worked, but the most efficient devices for the automatic delivery of oil to parts exposed to friction are liable to derangement. They either deliver too much oil or not enough, or perhaps not any. This is not entirely due to faulty design or construction, but want of proper care in keeping them in order is the primary cause of much trouble which *an improved construction might obviate.*

It may seem that too much space has been devoted here to this subject, but it is one of great importance and worthy the attention of inventors.

Another thing deserving attention is an improved form of parallel and connecting rods. The locomotive of the period has a different duty to perform from what was required of them a third of a century back, and consequently need improvement. The frequent breaking of those rods would suggest an improved form and a better distribution of material in their construction. When two light coaches and a baggage car was an average train, weighing 60 tons loaded, and 20 to 25 miles an hour the average speed, accidents from broken rods were comparatively few; but now, with long trains of heavy Pullmans, aggregating 200 or even 300 tons, with the high velocities of the day, it is a very different affair, and broken rods are frequent. The locomotive has been improved in *nearly* all its details, until now it is capable of some wonderful performances, but it does not appear that the past forty years have witnessed any improvement in the form and strength of connecting rods. The old style of rods were round in section, largest in the middle, and tapering toward the ends. These rods rarely if ever broke, their peculiar form enabling them to withstand strains and shocks and vibrations from whatever direction they might come. After a time some tasty (?) mechanic planed off the swell and flattened the sides of the rods "for looks." This, of course, took the metal from the very place where it was needed for strength. The next move was a plain flat bar with parallel sides and edges. Then came the fluted sides and edges, giving it the "I-beam" section. This latter form is not without its merits, nor is it entirely satisfactory for all kinds of service. For freight service the rods with the I-beam section rarely fail, but in the passenger service frequent failures are met with. These rods will bear the strain of handling heavy trains at the ordinary speed of freight trains, but with high velocities there are strains, shocks, and vibrations far in excess of what is experienced in handling freight trains. The forces which tend to destroy these rods act in so many different ways, and coming from various directions simultaneously, render it necessary to brace them in every direction, and this is an inviting field for the inventor. Make a hollow rod, a trussed rod, anything to gain the requisite strength without too much weight, or we shall be obliged to return to the old style of round, tapering rod.

A fruitful source of railway disaster is the frequent sliding of earth and rocks on to the tracks in cuttings and from mountain sides. Our best managed roads employ watchmen in all places where there is danger of such obstructions reaching the track, but notwithstanding the utmost vigilance accidents from land slides and rocks are frequent. A careful and trusty watchman may examine a suspicious rock or a loose slope and consider it safe and proceed to examine other localities, when a sudden storm or a dash of rain precipitates obstructions on the track that may destroy a train. This has often happened. Where is the inventor who can arrange a system of wires and torpedoes, or some effective danger signal, that will not fail to give warning when these obstructions reach the track?

Culverts and bridges are suddenly washed away, by which many lives and much property are lost. Signals may be attached to the timbers or supporting members of such structures in such a manner that any derangement or disturbance of rails or their supports will be made known in time to prevent disaster.

A properly arranged system of signals for the purposes named is greatly needed. WM. S. HUNTINGTON.

## THE "CITY OF PUEBLA"

Is the significant name given to a new iron steamship just built for Messrs. F. Alexandre & Sons, of New York, for the New York, Havana, and Mexican line. It is one of the signs showing, as do the railroads now building in the southwest and in Mexico, how rapidly we are approaching a larger and closer commercial intercourse with the republic to the south of us, into whose sluggish life and fifteenth-century ideas a large measure of Anglo-Saxon energy and enterprise is now, apparently, becoming steadily interfused. Among the cargo of the steamship on her first trip will be a street car, from one of our New York builders, for use in Vera Cruz.

The City of Puebla was built by Wm. Cramp & Sons, of Wilmington, Del. She is of 3,000 tons burden, 345 feet long, 38½ feet beam, 25 feet deep, and draws 19 feet of water when loaded. Her accommodations are for 100 first-class and 40 second-class passengers, the latter it being necessary to provide for from their contract with the Mexican Government. Her engines are estimated at 2,500 horse power, and it is expected she can be run up to a speed of 15 knots an hour, with a consumption of 55 tons of coal for 24 hours, though it is counted her average burning will be but 40 tons a day. All the machinery was built under the direction of R. W. Peck, engineer, and the principal novelty is in a peculiar form of unbalanced gridiron slide valve, designed by himself. The cost of the new steamship is something under half a million dollars. Mr. Cramp says that, with specifications complete in every detail for a similar steamship, it would be entirely safe to accept an order at an advance of ten per cent on the price for which any leading English or Scotch firm would contract to build such a vessel. The cabinet work, the finish of the machinery, and the general appearance of the ship, are very creditable to the builders, but each point of marked excellence noted only brings back with renewed force the old question: How much longer shall foreign built and owned vessels be permitted to carry nearly all our ocean freights?

### Science in the Navy.

The Navy Department has lately adopted a policy which promises no little advantage to the service and to science. Though the navy has been honored by the achievements of a considerable number of officers of eminence in scientific investigation, no effort has been made to encourage or assist the development of such men, the department choosing rather to employ civilians when any strictly scientific work has been required; and it is perhaps not too much to say that in general the professional spirit of the service has not been favorable to scientific studies.

At the suggestion of Admiral Rodgers and Professor Monroe, of the Naval Academy, the department has now detailed five midshipmen of scientific tastes and general intelligence for duty in the Smithsonian Institution, where, under the direction of Professor Baird, they will enjoy special advantages for pursuing their studies and for receiving practical training in the work of scientific observation and investigation. The opportunities for scientific study which our naval officers have in times of peace (which happily for the country are seldom interrupted) are constant and favorable, both in home and foreign waters, and the country cannot fail to be greatly advantaged if it becomes the fashion in the service to spend leisure time profitably. That any loss of courage or executive ability in war can follow from such studies is not to be imagined.

### A Big Pigeon Show.

The National Columbarian Society recently held its sixth annual exhibition in this city. Nearly 2,000 specimens were shown, representing Russian trumpeters, pouters, carriers, barbs, trumpeters, short-faces, jacobins, African owls, Chinese owls, English owls, turbits, fantails, swallows, magpies, nuns, Berlins, priests, bald heads, beards, runts, starlings, snells, archangels, breasters, homing Antwerps, Antwerps. Among these were many famous birds.

Among the noted birds of the homing class, or carrier pigeons exhibited, was Paris, a bird that returned from Indianapolis in 1881, a distance of 630 miles, and the second bird to return from that distance in America; Easton, the first prize winner in the 1880 race from Columbus, Ohio, making the best time on record for that distance; Boss, the winner of the $100 in gold offered to the first bird in America that should return from 500 miles. The race was flown in 1879; the birds were let go at 5:30 in the morning, and Boss arrived at 11:30 the next morning; Growler, from Steubenville, Ohio, 343 miles, when only twelve months old; Dandy, an imported bird, with a foreign record of 550 miles; Black Sam, well known in homing circles as the champion message bird; Susie, a hen with record from Steubenville; and The Pair, two birds that returned in a fog from Poughkeepsie in 1880, contrary to the theory that birds will not home in a fog.

### Strength of Materials.

At the late fair of the Massachusetts Charitable Mechanic Association, at Boston, examples were shown of tests of materials made by the machine lately erected in the United States Government Arsenal, at Watertown, for the proving of structures of full working dimensions. A steel wire cable, 1¾ inches diameter, was shown, which had withstood a pull of 75 tons, when the fastenings by which it was held gave way, although the cable itself remained sound. A hammered iron bar, 5 inches in diameter, was shown to have concealed a crystalline formation of the fibers, and it consequently parted with a loud report under a strain of nearly 723,000 pounds, or 36,900 pounds to the square inch. A smaller wrought iron bar drew down and broke with a fibrous structure under a pull of 51,340 pounds per square inch. Some pinewood columns were also shown which had been tested by compression. The first of these, originally 12 feet long, yielded at a pressure much below its estimated strength, in consequence of a large knot in the side, which acted as a comparatively incompressible wedge. Another column was a spar 12 feet long, 7¾ inch butt, and 6½ inch top. This stick was a perfect sample, and gave way by splintering at its smaller end. A seasoned hard pine girder, 11 inches square and 10 feet long, bore a load of 751,000 pounds.

### The Weight of the Brooklyn Bridge.

In a recent report in regard to the weight and carrying power of the East River Bridge, Engineer Roebling said that the aggregate strength of the cables is 12,300 tons, and the elastic limit 8,200 tons. The floor beams in the superstructure will sustain 140 tons each. The total weight of the bridge, with its transmitting load, is 17,780 tons; weight of main span, loaded, 8,120 tons, of which the cables and the long stays support 6,920 tons, and the trusses and short stays 1,180 tons. The reason assigned for increasing the height of the trusses was that the bridge should be used for every purpose to which it would lend itself.

### Revolution in a Herd of Deer.

For years an old buck, the leader of the deer herd on the Boston Common, has maintained an absolute and malicious tyranny over the younger members of his own sex. His treatment rankled, and the other day when he shed his horns they made a combined attack upon him, which only ceased upon the death of the tyrant. The superintendent and his assistants attempted to interfere, but were driven out of the inclosure by the infuriated animals, which became docile again when their enemy was disposed of. They still preserve, however, a sort of *sic semper tyrannis* air, and thus far no one of their number has laid claim to the primacy.

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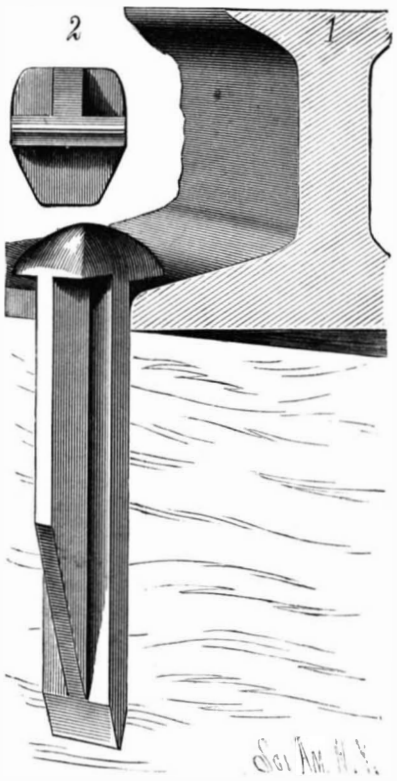
### IMPROVED RAILROAD SPIKE.

The engraving represents an improved railroad spike patented by Mr. Joshua B. Barnes, of Fort Wayne, Ind. It has much greater strength and rigidity than the ordinary spike, and is capable of being used over and over again, as it is not bent by the operation of drawing it from the tie. It has a broad bearing surface, and consequently holds the rails with great firmness, preventing them from spreading. The strengthening rib at the back or outer side stiffens the spike so that it is not bent in driving or extracting. This rib also strengthens the head, so that it is not liable to break off in cold weather. The inventor informs us that it takes




NEW RAILROAD SPIKE.

1,600 pounds more than the common spike to draw it out of the tie, while it weighs less than the standard spike.

Further information in regard to this improvement may be obtained by addressing Messrs. Barnes & Lincoln, Fort Wayne Ind.

### IMPROVED FURNACE FEEDER.

The engraving represents an improved device for feeding sawdust, shavings, and other finely divided fuel to boiler furnaces. It receives the fuel from the chute or conveyor and introduces it into the furnace, and also spreads it out upon the grate so that it will burn to the best advantage. The machine is exceedingly simple, and not liable to derangement. It is capable of application to any kind of furnace, and secures all of the advantages obtainable by regular and continuous feeding.

The invention consists of a reciprocating feeder moving forward toward the furnace door and retreating therefrom, and two spreaders connected with the feeder and reaching into the furnace above the grate. The feeder carries a hopper which receives the fuel from the carrier or chute, and delivers it to the feeder. The spreaders move forward with the feeder, and at the same time are spread apart by an arrangement of rollers engaging with the bent rear ends of the spreader bars.

The feeder is driven by a crank shaft driven by connection with suitable power. This is generally accomplished by means of belts and pulleys connecting with one of the shafts of the mill or factory.

The inventor states that the machine is in daily use in large mills, where it is giving great satisfaction, saving labor, and at the same time increasing the steaming capacity of the boilers. For further information address Mr. Israel Erickson, Whitehall, Mich.

### Phosphorescent Paint.

At a recent Thursday evening meeting of photographers, London, a question from the box was read: "Why is gas of poor quality whenever the barometer is low? This is asked with reference to the use of gas as a standard light for plate testing." Mr. A. Haddon said that, although the gas might be of the same quality, the light given out was less when burnt in low than in high pressure. Oxygen and hydrogen, which give, under ordinary circumstances, a flame with very little light, will burn with great luminosity when both are condensed.

A screen covered with Balmain's phosphorescent paint was then set up, and a gentleman posed in profile in front of it. A few inches of magnesium wire were then burned in such a position as to throw the shadow of the sitter upon the screen. When the gentleman quitted his seat his shadow remained distinctly visible. The part of the background not screened by him glowed with characteristic phosphorescence. Several cameras which had previously been focused upon the screen were now uncapped, and exposures of five and ten minutes were given. On developing, distinct images were seen upon the plates exposed upon the screen, as well as upon those which had been exposed upon the sitter himself while the magnesium was burning.

### Capacities of Lungs.

Dr. Nagorsky, having measured the capacities of lungs of 630 boys and 314 girls in the schools of the district of St. Petersburg, now publishes the results of his investigation in a Russian medical paper, the *Surgeon*. He has found that the capacity of lungs, in relation to the weight of the body, is 65 cubic centimeters for each kilogramme of weight in boys, and 57 cubic centimeters for girls. The law of Quetelet being that, with children below fifteen years of age, the weight of the body is proportionate to the square of the height, Dr. Nagorsky has found that it is proportional to 2·15 of the same; while the capacity of lungs is proportional to 2·4 of the height for boys, and to the square of the height for girls. Dr. Nagorsky's researches will soon be published as a separate work. As to the relation between the weight of man and the capacity of lungs, it is tolerably permanent, and its variations are mostly due to differences in the amount of fat in the bodies of different men.

### Photo-Engraving Process.

M. Gobert gave recently to the Photographic Society of France a very interesting demonstration of a photo-engraving process which has been given to the public by M. Stroubinsky, of St. Petersburg. The great authority on these matters of M. Gobert will certainly draw much attention to this process, which he (M. Gobert) describes as giving excellent results in his hands. He has slightly modified the process of M. Stroubinsky, which I here give for the benefit of the readers of the *Journal*. The modification I will describe afterward.

A copper plate is covered with the following solution:

| | |
|---|---|
| Water | 100 c.c. |
| Gum arabic | 5 grammes. |
| Bichromate of ammonium | 2 " |

The plate is allowed to dry in the dark. It is then exposed under a *cliché* of which the blacks of the line design are rather dense. When sufficiently exposed another solution is poured over its surface composed of bitumen dissolved in benzoline, to which is added a little drying oil (*linile siccative*). This is allowed to dry; the plate is then put into a tray of water, and left for five or six hours. The water penetrates this slight varnish and dissolves the gum which has not been influenced by the light. When all the soluble gum has been dissolved the plate is immersed in a solution colored by aniline. All the design can now be seen; and if any gum remain which ought not to be there it is easily detected, and the plate replunged into the water until it is eliminated. It is then plunged again into the coloring solution to see if the design is perfect and pure; if so, the plate is ready for the chemical engraving.

The chemical employed for this purpose by M. Stroubinsky is the perchloride of iron dissolved in alcohol in the following proportions:

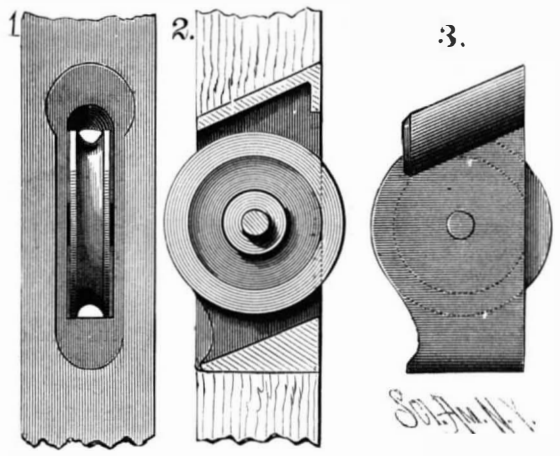
| | |
|---|---|
| Alcohol | 100 c.c. |
| Iron perchloride | 30 to 50 grammes. |

M. Stroubinsky thus gives his process. M. Gobert informed the society that, instead of employing gum arabic, he had succeeded much better by using albumen. The thinner the coating the better the results. In order to obtain a very thin coating, M. Gobert places the plate upon a pneumatic holder, to the handle of which is attached a hook. This hook is also attached to a string hanging from the ceiling. As soon as it is covered with the sensitizing solution the plate is turned topsy turvy and hooked on to the string. A circular motion is then given to it, and by revolving it throws off any excess of liquid, and thus a very thin and even coating is obtained.

M. Gobert developed a proof by plunging it into water, then into the coloring solution, and passed round for the inspection of the members a number of copper plates of bank notes, etc., which he had obtained by the aid of M. Stroubinsky's modified process. A vote of thanks was unanimously given to M. Gobert.—*Prof. E. Stebbing, in Brit. Jour. Photography.*

### IMPROVED SASH-CORD GUIDE.

The annexed engraving shows an improved sash-cord guide lately patented by Mr. Alexander Millar, of 305 East




MILLAR'S SASH-CORD GUIDE.

John Street, Baltimore, Md. This guide or pulley can be more cheaply made than other styles of pulley, and can be placed in a mortise made by hand or in a machine.

The mortise required for this guide is made almost entirely by boring with bits, and requires very little paring or cutting with chisels. The mortise can be readily made on a machine, and to facilitate making it by hand the inventor has devised a bit guide that holds the bit at the proper angle.

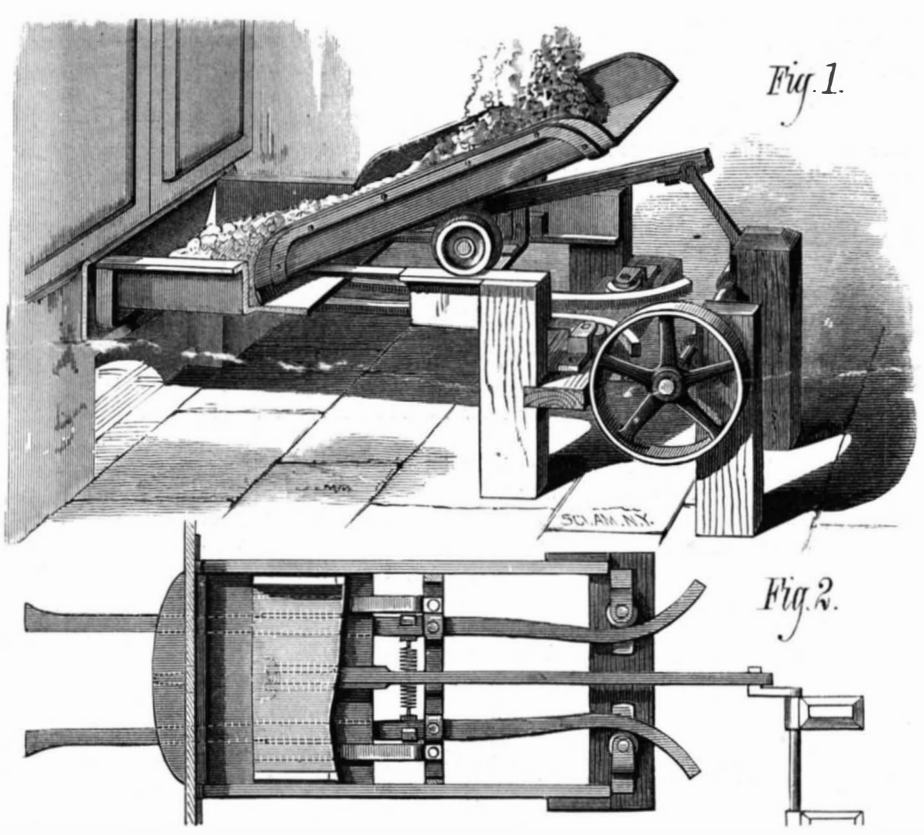
The sheave is mounted on a pivot in the casing as usual; the casing is made in a single casting. The bottom of the casing is of semicylindrical form to adapt it to a mortise made with a bit, and the top, which is also cylindrical, is inclined and made somewhat thicker than the casing.

To insert the device by hand, a hole is bored, with an ordinary bit, of a size to fit the upper or cylindrical part, and at an angle with the face of the window frame equal to that at which the upper edge of the casing meets the face. A second hole is bored at the proper distance below the first, of a width equal to that of the casing, and the wood between the holes is chipped out with a mallet and chisel. The swell is fitted in the top or larger hole, and the sheave casing is pushed downwardly and rearwardly until the bottom abuts against the base of the mortise, when the face of the casing will necessarily be flush with the window frame.

It will be seen that the entire weight of the sash and balance is sustained by the base of the casing, and there is no tendency to cause the casing to project from the face of the frame and in the way of the sash.

The mortise may be cut by means of a laterally cutting bit in a suitable machine.

All communications in regard to this invention should be addressed to the inventor, or F. H. Davidson & Co., 158 Franklin street, Baltimore, Md.




ERICKSON'S FURNACE FEEDER.

### An Electrical Stature Alarm.

A curious application of electricity is described in *La Lumière Electrique*. It consists in a device to prevent military conscripts practicing fraud as to their stature by bending their knees. When the youth stands erect against the measuring post, the hind parts of the knees press on electric contacts, causing two bells to ring; the ringing ceases when there is the least bending. The sliding bar which furnishes the measure has also a contact, which is pressed by the head, whereby a third electric bell is affected. For a correct measurement, the three bells should ring simultaneously. This system, the invention of M. Cazala, is now employed in the Spanish army.

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## AMERICAN INDUSTRIES—No. 81.

### HEMLOCK SOLE-LEATHER TANNING.

In all the northern counties of Pennsylvania, from Port Jervis almost to Lake Erie, a vast industry is conducted in the manufacture of hemlock sole leather. It is only about twenty years since this region was first largely occupied by tanners, but there are comparatively few sections here now, throughout its whole extent, where tanners have not "prospected," as it were, in looking out favorable locations for their tanneries. Every new railroad, and every minor branch of a road, running through land on which hemlock timber was standing, has added new facilities for reaching the bark supplies necessary for the tanner, and many such roads have been built expressly for this purpose; but the supply is yet abundant, on going back far enough from the thickly settled portions of the country, and probably will continue so for at least a generation yet to come. What we will do then, or rather what our children will do, is a problem which the tanner who has cheap and abundant bark to-day troubles himself very little about.

In the illustrations on the first page of this paper we give a representation of a new tannery, but just well under operation, which is at once one of the largest and most complete establishments of the kind in the world, the "Brunswick" tannery, of Messrs. Hoyt Brothers, of New York. It is situated in Tioga county, Pa., about twenty miles from Blossburg, and forty miles from the New York State line, in the midst of a dense hemlock wilderness, where, for ten miles in every direction from the tannery, it is estimated that the bark on the trees will yield from eight to fifteen cords per acre. The firm, in connection with the Blossburg Coal Co., have built a branch railroad from Arnot to the tannery, and it is expected that this road will give the tannery a large proportion of its supply of bark.

Only those familiar with the tanning business comprehend why it is that in this country the tanneries are thus built way off in the woods. The answer lies on the surface.

It requires about 2,000 pounds of bark to make 150 to 175 lb. of good sole leather, and so, not counting at all the large ground space required by a great tannery, it is cheaper to take the hides to where the bark is than it would be to bring the bark to the seaports where the hides are imported, or the large centers where hides of domestic production are collected. This is not so much a distinctive feature in upper leather and calfskin tanning, where much less bark, proportionately, and a great deal more labor are required, nor is it true in regard to the sole-leather tanning business of any other country, for nowhere else in the world are to be found whole sections of country with such abundant supplies of bark, the growth of the original forests. In England, for instance, where the standard of excellence in sole leather was first made by the "butts" and "bends" so famous in all the markets of the world half a century ago, it is now a rare thing to see a thousand cords of bark on hand at one time at any of the leading tanneries. Very little bark is used in any of the tanning there, its place being taken by gambier, valonia, divi divi, and myrobolans, from the East Indies, the Levant, and tropical sections of South America, and portions of Africa, with the mimosa from Australia. These tanning agents are more concentrated, affording strong tan liquors, and heavy, good-looking leather can be made therewith, but the leather is not as serviceable for wear as that made with bark. The tanners of nearly every other country are, however, compelled to use them because of the scarcity and high price of bark, the price in England now being equal to about $30 per cord. Our sole-leather tanners use bark only, its abundance here making it much the cheapest, as it is acknowledged to be the best tanning material. Its cost, at most of the large tanneries in Pennsylvania, will not exceed from $4 to $5 per cord, and the establishment which forms the subject of our illustrations enjoys exceptionally good facilities for obtaining a cheap and abundant supply, the bark sheds connected with the "Brunswick" being calculated to hold a stock of 10,000 cords.

In the view of the location and arrangement of the tannery buildings, shown in the center of the page, but a limited idea of the extent of the business will be conceived unless it is remembered that these buildings extend over nearly thirty acres, and the plan is such that the progress of the stock, from the time it enters as raw hide until it leaves as finished leather, is never backward or over the same ground twice. The building in the foreground represents the shipping house for finished leather, where it is loaded directly upon cars, the tracks for which run through the building. Beyond this, and between the two largest structures on the grounds, may be seen the receiving and storehouse for hides, where they are unloaded direct from the cars. From the hide house the stock is first taken to the soaks in the front end of the great building to the left, which constitutes the yard proper; adjacent to this are the sweat pits, and here are the hide mills and beamsmen, the handling vats coming next, and the lay-away vats extending all down the length of the building. About midway down, and including a passageway to the structure at the right, is the scrubbing department, whence the leather goes to the drying lofts, and thence to the rollers, in the front part of the same structure, where it is very near its place of shipment from the tannery. On the extreme left are the bark sheds; a large building is occupied by the mills for bark grinding, adjoining which is the leach house and a boiler house, another structure being provided in which are large tanks for cooling the tan liquors.

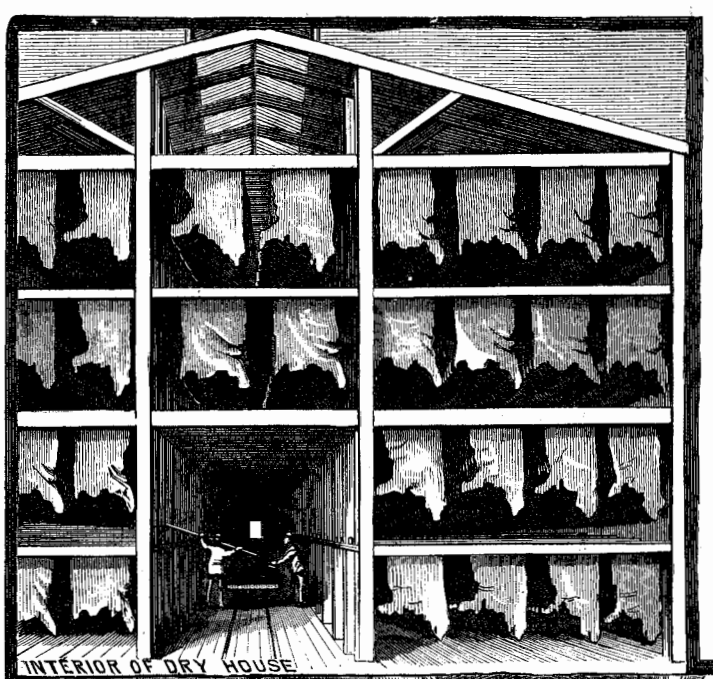
The first operation upon the hide entering the tanning process is the soaking. This is always necessary, whether green, salted, or dry hides are worked, to soften and clean them, but in this tannery dry hides are used exclusively which are principally imported from South and Central America, or received from Texas and California, the best grade of dry hides generally coming from Buenos Ayres and Montevideo. The hide, as taken from the animal, contains so much moisture that the weight of a sixty pound hide, if dried quickly in the sun or otherwise, to prevent putrefaction, will be reduced to about twenty pounds when dry. The freshly taken-off hide or skin needs comparatively little soaking, but only sufficient washing to clean it from blood and impurities; the dry hide, however, must be soaked until it is thoroughly softened, or brought back as nearly as possible to the condition it was in when first taken from the animal. For this purpose from three or four days to a week is usually required, and sometimes longer, dependent upon the condition of the hide, the time of year, the water, etc.

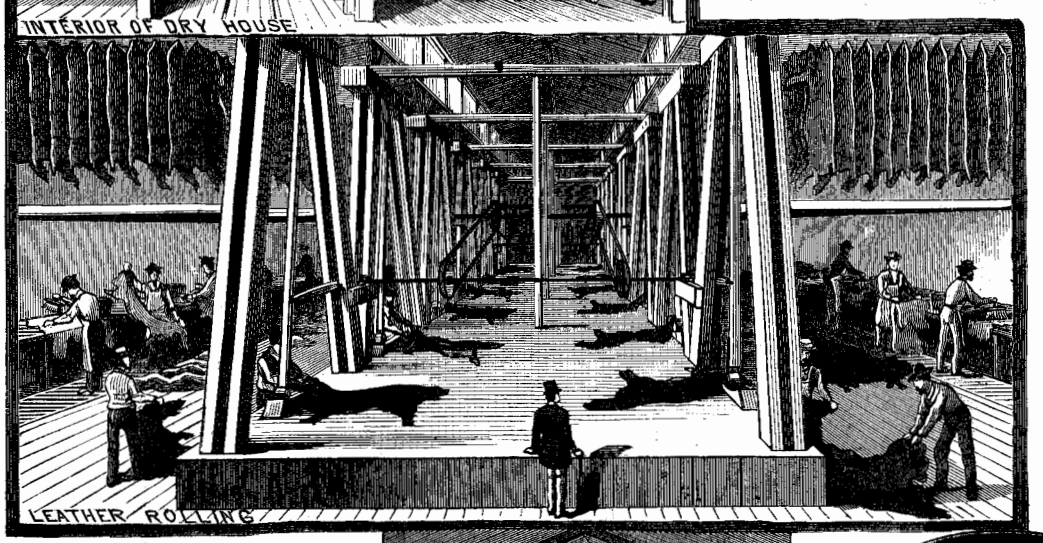
An abundant supply of pure water is one of the prime necessities of a large tannery, and it is important that it should not be what is commonly known as "hard" water. There is very little natural spring or river water, of average freedom from soluble impurities, which is not suitable for tanners' uses, but a large creek, flowing from the hills and through the woods which surround the tannery, affords an ample supply of comparatively soft water.

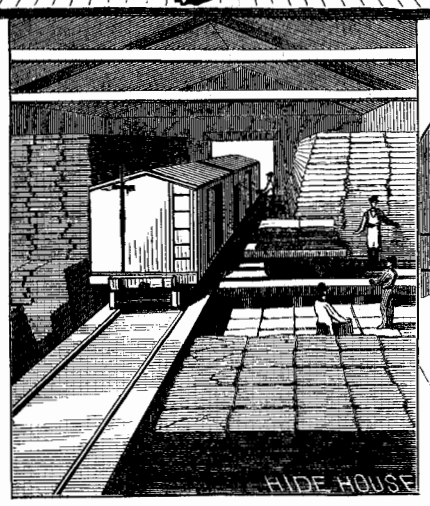
After the soaking, which is effected at the end of the yard where the hides are first received, and where the hide mills and beamsmen are located, the hides go first to the sweat pits, in an adjoining building, whose sides appear sunken below the earth, only the roof being seen, but the floor of which is, in reality, on a level with that of the rest of the tanyard. The hides are taken here, as in fact they are moved from one portion of the tannery to the other all through the process, on light cars, easily pushed over tracks laid for this purpose. Two views of the sweat pits may be seen on the sides at the top of the page, one showing the arrangement by which they are all reached in the common entrance from the tanyard, and the other giving an interior view of one of them, as the hides are hung in "sweating." The sweat pits, or vaults as they more properly appear here, have double doors, and are made so that, when the hides are hung up therein, they will be as much as possible removed from any effect of outside air. When the wet hides are hung up here in a close atmosphere, kept at a uniform temperature, their natural tendency to decay is likely to quickly manifest itself, and an incipient putrefactive fermentation soon becomes apparent in the strong smell of ammonia they give off. The hide swells as this proceeds, and the cells at the roots of the hair become enlarged, until the hair will readily "slip" when the hide has been sufficiently long in the sweat. During this process, however, extreme care and the best of judgment are necessary; only hides of about the same weight, character, and condition should be started together, and then frequent examinations must be made by the workman in charge, so that if any of them seem to have been sweated sufficiently before they have all arrived at that stage, the most forward ones may be immediately removed, as a very short delay here would be highly injurious to the leather. Concerning the temperature which should be maintained in these sweat pits tanners differ widely in practice Formerly it was considered necessary to keep it down as low as 50° Fah., whence came the designation of this process as the American "cold-sweating" system, but now the temperature varies with different tanners, all the way from 60° to 75° Fah., the operation proceeding slower or more rapidly accordingly, although a still lower temperature may be advisable when there is danger from the condition of the hide. The hides themselves may be so managed that the heat they give off will keep up a proper temperature during the greater part of the year, with the necessary washing of the floors and sides of the pits, and the use of a little steam in winter, the ventilators being opened to allow of the escape of ammonia, which comes off freely when the putrefactive fermentation is set up. Abundance of moisture in the atmosphere is also requisite in the sweat pit, but the pores of the hide, as hung up, being filled with water, will keep the surrounding air always damp. About a week is ordinarily taken for the sweating of heavy hides, though sometimes only three or four days are necessary, and, exceptionally, even less than that.

As the hides come from the sweats the hair has been so loosened that the greater portion of it will readily come off in a brief working in the hide mill. One of the views shows the operation of these mills, which are in principle nothing more or less than the old-fashioned fulling stocks, intended to pound and tumble over the hides without breaking or in any way injuring the surface. A stream of water is kept running on the hides as they are subjected to this operation, and a good part of the hair is thus with little trouble removed. The hides, after being soaked, are milled before being put into the sweat pits, and if not sufficiently soft are thrown back into the soaks until they are.

The "beam-work" of a tannery is well illustrated in the main view at the top of the page. Each hide is taken separately over a tanner's beam, and the hairs not before removed are worked off, while the extraneous flesh on the other side is cleaned down to the true skin. This not only allows the tan liquors to more readily penetrate the pores of the hide, but, where the fleshing is well done, it makes a more solid,



HEMLOCK SOLE-LEATHER TANNING.

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sightly, and serviceable leather. Thirty hands are here employed at work over the beam, and great care is given to this department, for much attention has been called to the proper "fleshing" since we began to be large exporters of sole leather. The best European tanners flesh their sole leather very closely, and the custom of most English tanners is to give the flesh side a smooth and clean appearance by a kind of pasty covering, which certainly does not add to the value of the leather, although considerable increase in its weight is thus made. Without going to the extreme of close fleshing, which some European customers have desired, there has been great improvement among our tanners in this direction within a few years past, while nowhere is it a practice to put on any extraneous substance to cover up cuts or defects in the flesh, or add to the weight.

When the hide comes out of the soaks it is cut in halves along the back from the head to the tail, and these two parts are thereafter known as sides. This is the only "trim" usually made in hemlock sole leather before it is sold to the manufacturer, although in oak leather, and in the mixed tannage of oak and hemlock known as "union," it is common to cut off, and sometimes tan separately, the bellies, or pate, bellies and flanks, the leather being then known as "crops" and "backs" respectively—the latter being nearly the trim of what is known as English "bend" leather, while the "butts" would represent the hides thus trimmed of all the lighter or more spongy portions, but not cut down through the back. All of the American boot and shoe manufacturers, however, and most of our foreign customers, since they have become accustomed to the use of "side" leather, prefer it in that way, as they can use the inferior portions for inner soles, heel lifts, stiffenings, etc., and the thickest portions for outsoles, with greater latitude in their selections as to quality and kind of stock required for each.

Of the "handling," which is the first operation of the tanning proper, our artist has given a single illustration, showing the manner of proceeding, as also with the "laying away;" but both these operations are likewise represented in the larger view at the bottom of the page, the first process running into the second, taking up nearly all the room of the principal building. The hides, as they come clean and white from the beamsman, are thrown first into a vat containing weak tan liquor, of just sufficient strength to color the grain or hair side, and partially strike through the grain. It is the combination of the tannic acid of the bark with the gelatine of the hide which alone makes true leather. It is also necessary, if possible, to somewhat distend or "plump" the hide.

And here we come to one of the great questions in the tanning business, about which the doctors in the trade have long disagreed, namely, the proper method of plumping and the feeding of the hide with tan liquor in its early stages. The hide, as it comes from the sweat pit, where the incipient putrefactive fermentation has been sufficient to loosen the hair, must have prompt treatment with some counteracting agent, or it will "run," so as to lose gelatin, and thus lessen the weight of the leather, or damage the grain, or make "black rot"—risks which have to be carefully looked out for in all the early stages. The handler liquors should be of sufficient strength to at once stop this tendency, and they should be such as will also open the pores of the hide. In hemlock sole leather there are two general classes in the market, commonly known as "acid" and "non-acid," according to the plan followed at this stage of the process. The first takes its name from the fact that sulphuric acid, though diluted to about the strength of a weak vinegar, is used in the handlers to plump the stock and assist to stop decay, while the non-acid leather is so called because only the liquors derived from the bark are employed. In the latter case, however, a tan liquor which is not only weak, but which has become sour or oxidized from exposure to the air, is found most efficient, both to stop decay and plump the leather. The "acid" or vitriol plumped leather always has a thin grain and a dark streak under the grain, which is very objectionable to manufacturers, who buff off the surface of this grain to make a clear, fair, even-colored bottom; "acid" leather has, also, a tendency to be harsh and brittle, though this is not always the case, some of the most solid leather for heavy work being of this class. In the non acid leather, also, if the liquors used in the handlers be too old and sour, the grain will not be light-colored, though it will not have that distinctive dark streak. There is a nice mean to be sought here, which has been successfully attained by our best practical tanners only. The "Brunswick" tannery is a non-acid yard, and the firm who built and are operating it have made for themselves a wide reputation, wherever hemlock sole leather is used, for the excellence of their product in this line of manufacture. Their leather has been solid and of good substance, fine-textured, excellent in grain and clear in color, just such as is required by the first-class boot and shoe manufacturers, making a handsome looking and good wearing bottom.

The process of handling in the tannery occupies from two to four weeks according to the kind and condition of hide and the state of the liquors. The strength of the liquors is gradually increased as this department of the work proceeds, so that, while the first handlers have a strength or weight of sour tan liquor of four to six degrees, the last ones will have a sweet tan liquor weighing from twelve to sixteen degrees. The weight or strength of liquors is usually tested by what tanners call a "barkometer," but which is really nothing more nor less than a hydrometer, so arranged as to be best adapted for tanners' use, with a scale which marks, for the strength of liquors that can be ordinarily leached from hemlock or oak bark, without evaporation, about thirty-five to forty degrees, although, of course, with any artificial abstraction of their moisture, or the further adding of extraneous matters which would be held in solution, the weight would be correspondingly increased. In the bark extract manufacture, which is now a considerable industry in this country, tan liquors are evaporated down to about two hundred degrees, according to a similarly proportioned scale.

Next we come to the lay-aways, where, the grain having been thoroughly colored and "struck through" with the tan liquors, the sides are "laid away." One of the views shows the manner in which this is done, a workman standing by and throwing one or two shovelfuls of ground bark on each side as it is laid down, and, after the pile reaches the top of the vat, enough tan liquor is run in to cover the whole. Each lot of hides, in going through, receives five lay-aways, except in case of very heavy ones, which may receive the sixth, the time occupied in the first ones being from five to ten days, and in the last ones from three to six weeks. With each change, however, the sides are given a stronger liquor than was the preceding one, until, in the last lay-away, the strength of liquor reaches from thirty-two to thirty-six degrees, or as much as any leaching process will get out of the bark. The time usually occupied in the tanning is about six months, including the drying and rolling, although somewhat longer is frequently consumed, especially with heavy hides, it being considered quite advantageous to let the leather lie as long as possible in the heavy liquors of the last lay-aways.

The preparation of the bark liquors properly commences with the grinding shown in one of the views. The bark is peeled in the woods in the spring, and is piled and allowed to season for a few months, or until the following winter, most of the tanners having their bark hauled in the winter, when the snow is on the ground. All of the bark coming from any considerable distance will be brought in by rail, and all is unloaded from the cars or vehicles bringing it directly opposite the bark mills, except the quantity they will keep ahead in stock, their usual policy being for the present, while the supply is so abundant, to have it brought in only about as needed, and thus save the extra handling. The mills at the top have something the appearance of iron hoppers, about twenty-four inches in diameter, over the edges of which the attendant roughly breaks and feeds in the bark. There are many different styles of bark mills, but the great point necessary in a good mill is that it grind evenly, and of sufficient fineness, without also making dust, while it will at the same time do the work with sufficient speed, without being unduly liable to break or get out of repair. The mills here grind very evenly, reducing the bark to about the average size of grains of wheat, and in their fitting up no pains have been spared to provide ample power and use every precaution against possible break-downs. The gearing running these mills is below the floor, and is shown in a special view on this page. Perhaps the most noticeable feature of this department, however, is the entire absence of bark dust, with which the air is generally filled and all surrounding objects covered everywhere in the neighborhood of the bark grinding in most tanneries.

The explanation is found in the fact that the bark, as it leaves the teeth of the grinders, is received into a thin, slow-moving stream of water, and is in this way conveyed to the leaches.

The leach house is a large building, shown in one of our views, the leaches themselves being not unlike the vats or handlers in which the leather is tanned. Into these leaches, by a system of covered troughs which enables the current from the bark mills to be floated into every part of the leach house, the water carrying the ground bark flows according to a regular system, which can be changed to meet each day's requirements. They are then warmed up by steam pipes running into them, but not heated sufficiently to extract the resinous and coloring matters of the bark, which would be the case if the temperature was raised to the boiling point. There is a great difference of opinion among tanners as to what degree of heat should be used in this process, but the best test of the excellence of any method is to be found in the quality and color of the leather. After the liquor has thus stood a sufficient time to mainly exhaust the strength of the bark, it is drawn off and another liquor put on, with a similar process, the bark being thus "washed," as it were, three or four times, until its strength is exhausted, and the liquors are pumped into the large coolers adjacent to the yard. It is necessary, however, in order to make the strong liquors required in the later stages, to put the same solution several times through different leaches, each one raising the strength, until the practical limit is attained in a weight of about thirty-five degrees.

At the sides of the leaches, with low supports in the passage way, run long, slow moving endless chains, with slats at frequent intervals, on which is pitched the wet spent tan from the leaches, after it has been thoroughly exhausted of its tannin. These belts carry the spent tan to the furnace room and automatically dump it over the feed holes of the great wet tan ovens, in such way that only mere nominal attention is required at any time to see that the fires are well kept, during all the working hours of the day at least, from one month's end to another. These ovens are built according to what is everywhere known in the trade as the "Hoyt system," a designation for them which was accepted by Judge Blatchford, in the famous Thompson wet tan suit, about ten years ago. The decision of the court in this case was widely commented upon as maintaining the validity of a patent which, to some extent at least, set up the advantages of water itself in fuel, and claimed that it was actually and advantageously dissociated in a certain described system of ovens, operated in a specified way. The "Hoyt" ovens, however, which were not considered as coming under this patent, are simply structures with high grate bars and good smokestacks, to insure strong draught, with ample grate surface and a high arch, to insure plenty of room for a large body of fire, beside an unusual proportion of wet and charred fuel constantly coming into condition for actual combustion. They are set in front of the boilers, and, for, convenience, are automatically fed from the top as described. The fire once thoroughly started and the walls heated, there is no difficulty with these ovens in getting plenty of steam at any sole-leather tannery, provided the ovens have been properly built and made large enough. They require more fuel than they would if the tan were dry, but spent tan is a drug at all the great sole-leather tanneries, and some of the tanners have put in much larger ovens than they need, as the readiest means of getting rid of their spent tan. In one instance, at least, within the writer's knowledge, complaint was made of a tannery at a certain town in Maryland for blowing off steam so much of the time, which was caused in this way.

From the nature of the case, therefore, there is no reason why a sole-leather tannery should be wanting in any facilities which an abundant supply of power and steam for heating will supply, and the new "Brunswick" tannery is exceptionally well fitted up in this particular. It has ten boilers, thirty-eight inches in diameter by thirty-six feet long each, to make steam for heating the buildings, heating and pumping liquors and water, and running a half dozen different engines in the various parts of the tannery, for there is no part of work in which power can be advantageously used where it is not supplied in abundance.

After the leather has come from the final lay-aways, and been allowed to drain as piled up for a little time, it is taken to the scrubbing department. Here are large drums, with doors in their ends, for putting in and taking out the leather, these drums being formed of open work of heavy slats, and sunk in vats where a stream of water is kept constantly running. The leather is revolved in these drums until the bloom, stains, gum, and sediment which may have accumulated on it during its stay in the vats are washed away, after which it is piled up on one side to drain. A rough coating of cod oil is then brushed over each side, and the leather is moved on to the drying loft, a building nine hundred and fifty feet long, with ample ventilators at the top. Four tiers of sides are hung here, one above the other, the steam pipes with which the room is abundantly supplied insuring a constant circulation of warm dry air. An illustration on this page gives a sectional view of this department.

The only operation now required before the sole leather will be ready for market is the rolling, conducted in a building which constitutes a forward extension of the drying lofts. Before rolling the leather is again slightly dampened and oiled, the object being to bring it into what tanners call a properly "sammied" condition, or very similar to the "temper" which shoemakers give it before hammering to shape it over the bottom of the last. Especial care is necessary not to have the leather rolled too hard, which would hurt its quality in the eyes of many manufacturers. The beds of the rollers are brass-faced, narrow, and about twenty inches long, concave, in which swings a roller on an arm, with a sort of pendulum motion, a treadle allowing the workman to put on any desired pressure, and the table affording ample room for moving the side about in bringing its different parts under the roller. In this way the two surfaces are made firm and smooth, and a high polish given to the grain side.

The working facilities at this tannery exceed probably those of any other tannery in this country, and it is certainly now working in a greater number and weight of hides than was ever before done in one establishment. It was intended to tan 500 hides, or 1,000 sides of leather, per day—all standard, full weight sole leather, and this number has actually been worked in now continuously for several weeks. America could years ago boast of the largest sole leather tannery in the world, but there were several establishments here which, though larger than those of any other country, were so nearly equal in capacity that it seemed almost invidious to place one above the other in such a comparison. The "Brunswick" has now settled this question with a production which excites wonder among our own tanners, and will, no doubt, provoke many expressions of incredulity abroad.

Of the firm who illustrate their business enterprise in an undertaking of this magnitude, words would be superfluous among New York merchants, or almost anywhere in the world where there is any considerable market for sole leather.

Their warehouses are at Nos. 72 and 74 Gold street, New York, and they also have a store at No. 132 Summer street, Boston.

### Growth of Chemical Manufactures in the United States.

In a recent communication the Secretary of the Manufacturing Chemists' Association of the United States gives incidentally some figures which strikingly exhibit the importance of chemical manufactures in this country. The capital invested is $85,000,000; the annual production is worth $118,000,000; the number of manufacturing establishments is 1,346, using 600,000 tons of coal, and employing 30,000 working people, whose wages amount to $12,000,000.

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### The Use of Plaster of Paris in Fractures.

Plaster, either in the form of a bandage enveloping the fractured part, or in the form of a distinct splint, is used quite extensively in the various hospitals of this city. In fact, all other things being equal, it is given the preference over other forms of apparatus usually employed in such injuries. Particularly is this the case with fractures of the leg, which are treated now almost exclusively by this bandage. The fracture box is rarely used, and only in exceptional cases, where there is great swelling, and under conditions of extensive injury of the skin, in which it is necessary for the parts to be exposed during treatment. Generally this open method is only employed until such time as it is safe to apply the plaster of Paris bandage, as shown by the disappearance of the swelling and the healing of the abrasions. No time is lost in so doing, as generally the parts are made fit for the immovable apparatus before the bony union commences. In compound fracture the limb is generally placed at once in the plaster apparatus, openings being made in the latter corresponding with the injuries of the soft parts, for the purpose of establishing thorough drainage. As a rule, and when, of course, there is no special contraindication in the shape of undue swelling, etc., all fractures in which plaster of Paris is to be employed are "put up" at once. A general description of the method of procedure may apply to that to be employed in any case of fracture in any region of the body. The part is enveloped in a thin layer of cotton, and the bandages, immersed in water sufficiently long to be permeated, are applied directly over the cotton, care being taken to exert slight and uniform pressure. Each layer of bandage is carefully moulded to the inequalities of the surface, and made perfectly smooth before the next layer is applied. If the bandages are properly prepared, without sizing, and have been kept in a dry place, the plaster will commence to "set" before the second bandage is applied. Generally three layers of bandage are sufficient for a fracture where ordinary support is required. Four, with suitable re-enforcements, may be required in other cases. After the dressing is complete, it is exposed to the air, and hardens sufficiently in two or three hours to allow the limb to be moved.

The plaster apparatus is generally kept in position during the whole period of treatment. If undue swelling occurs, the envelope is slit in the long axis of the limb by a Hays saw, or by scissors for the purpose, and thus a splint is formed which is kept in position by outside bandages.

Some surgeons prefer to dispense with cotton altogether, and use a well-fitted silk or gauze stocking or jacket as the foundation for the plaster. There is, however, greater care and skill required in this method, as any undue pressure at any one point would be more apt to produce swelling in the parts beyond. Yet still, when properly applied, this makes the most comfortable and lightest dressing that can be used, and gives the perfection of support and greatest accuracy of adjustment to the injured parts.—*Med. Record.*

### Morning Work.

Perhaps, on the whole, moderately early rising is now a commoner practice in cities than it was forty years ago. It seems strange that the habit of lying in bed hours after the sun is up should ever have obtained a hold on the multitude of brain-workers, as undoubtedly it had in times past. Hour for hour, the intellectual work done in the early morning, when the atmosphere is as yet unpoisoned by the breath of myriads of actively moving creatures, must be, and, as a matter of experience, is incomparably better than that done at night. The habit of writing and reading late in the day and far into the night, "for the sake of quiet," is one of the most mischievous to which a man of mind can addict himself. When the body is jaded the spirit may seem to be at rest, and not so easily distracted by the surroundings which we think less obtrusive than in the day; but this *seeming* is a snare. When the body is weary, the brain, which is an integral part of the body, and the mind, which is simply brain function, are weary too. If we persist in working one part of the system because some other part is too tired to trouble us, that cannot be wise management of self. The feeling of tranquillity which comes over the busy and active man about 10:30 or 11 o'clock ought not to be regarded as an incentive to work. It is, in fact, the effect of a lowering of vitality consequent on the exhaustion of the physical sense. Nature wants and calls for physiological rest. Instead of complying with her reasonable demand, the night-worker hails the "feeling" of mental quiescence, mistakes it for clearness and acuteness, and whips the jaded organism with the will until it goes on working. What is the result? Immediately, the accomplishment of a task fairly well, but not half so well as if it had been performed with the vigor of a refreshed brain working in health from proper sleep. Remotely, or later on, comes the penalty to be paid for unnatural exertion—that is, energy wrung from exhausted or weary nerve centers under pressure. This penalty takes the form of "nervousness," perhaps sleeplessness, almost certainly some loss or depreciation of function in one or more of the great organs concerned in nutrition. To relieve these maladies—springing from this unsuspected cause—the brain-worker very likely has recourse to the use of stimulants, possibly alcoholic, or it may be simply tea or coffee. The sequel need not be followed. Night work during student life and in after years is the fruitful cause of much unexplained, though by no means inexplicable suffering, for which it is difficult, if not impossible, to find a remedy. Surely morning is *the* time for work, when the whole body is rested, the brain relieved from its tension, and mind power at its best.—*Lancet.*

### The Space Occupied by Coal.

Few persons have an idea as to the amount of coal that can be stowed in a given space. Manufacturers think they have not enough room, even though they may be offered a bargain. We, therefore, give an example of the manner in which it may be figured up. A shed or room, 15 feet high, 18 feet wide, and 30 feet long, will hold 200 tons of anthracite coal, and perhaps 10 tons less of Cumberland. Thus, 15 x 18 x 30 = 8,100 × 40 = 202½.

The average number of cubic feet required to stow a ton of coal is as follows:

| | |
|---|---|
| **BITUMINOUS.** | |
| Cumberland, maximum | 42·3 |
| " minimum | 41·2 |
| Duffruyn, Welsh | 42·99 |
| Cannel, Lancashire | 46·37 |
| Blossburg, Pa. | 42·2 |
| Hartley, Newcastle | 44 |
| Pictou, Nova Scotia | 45 |
| Pittsburg, Pa. | 47·08 |
| Sydney, Cape Breton | 47·02 |
| Clover Hill, Va. | 49·02 |
| Cannelton, Indiana | 47 |
| Scotch | 43·08 |
| Richmond, Va. (Midlothian) | 41·04 |
| **ANTHRACITE.** | |
| Peach Mountain | 41·06 |
| Forest Improvement | 41·07 |
| Beaver Meadow, No. 5 | 39 08 |
| Lackawanna | 45·08 |
| Lehigh Co.'s | 40·05 |
| Beaver Meadow, No. 3 | 40 07 |
| **COKE.** | |
| Natural of Virginia | 48·03 |
| Pittsburg | 70·09 |
| Charcoal | 104 |

It is usually stated that a ton of coal "in the hill" measures about a cubic yard, or 27 cubic feet.

A prominent retail dealer in Philadelphia informs us that from many years' experience he finds the cubic contents of 2,240 pounds of hard Lehigh coal to be a little over 36 feet; an average Schuylkill W. A., 37 to 38 feet; Shamokin, 38 to 39 feet; Miller, Greaff & Co., Lorberry, nearly 41.

According to measurements made with Wilkesbarre anthracite coal from the Wyoming Valley, it requires 32·2 cubic feet of lump, 33·9 cubic feet of broken, 34·5 cubic feet of egg, 34·8 cubic feet of stove, 35·7 cubic feet of chestnut, and 36·7 cubic feet of pea, to make one ton of coal of 2,240 pounds; while it requires 28·8 cubic feet of lump, 30·3 cubic feet of broken, 30·8 cubic feet of egg, 31·1 cubic feet of stove, 31·9 cubic feet of chestnut, and 32 8 cubic feet of pea, to make one ton of 2,000 pounds.

### Silvering of Large Telescopic Mirrors.

At a recent meeting of the Royal Astronomical Society, Mr. Common read a paper on "Silvering Large Mirrors." He said that the chief difficulty in silvering large mirrors was due to their weight and the difficulty of handling them and turning them face downwards into the silvering solution. His own mirror was 37 inches in diameter and 4½ inches thick, and weighed over 400 pounds. It was difficult to handle such a heavy mass of glass, and turn it over without doing some damage with the tackling and pulleys that were necessary to move it. The plan which he had adopted was to make use of a large sucker to hold the mirror. The atmospheric pressure was partly removed, and the sucker could then be attached to pulleys, and carried the mirror along with it. The sucker consisted of a shallow cylindrical iron box, which rested upon an India-rubber ring at the back of the mirror. The atmospheric pressure was removed by means of an air pump, and a mercury gauge attached to the box showed the amount of exhaustion. He found that a difference of four inches of mercury between the atmospheric pressure and the pressure within the box was amply sufficient to lift the weight of the mirror. For silvering solution he made use of glucose and water and nitrate of silver, and got a very good film in about forty minutes, so that if the flat became dewed while he was observing, he had no hesitation in removing the film, and could resilver it and have it back in its place within the hour.

When the mirror was first silvered, in the autumn of 1879, he devoted it principally to observations of the satellites of Mars. They were not good test objects to give an idea of what a mirror would do, but he thought he had a better film with that process than he had before. He observed Saturn last year, and during 1879, and got a few observations of Mimas when near to the end of the ring. And on the first of December he turned the instrument on Mars, and saw Deimos pretty plainly.

### A Notable Bridge.

An iron bridge now building across Murderer's Creek, near Newburg, N. Y., for the New York, Ontario, and Western Railroad, will be one of the notable bridges of the country. It will be 1,206 feet long, and 150 feet high, or 680 feet longer than the Niagara Suspension Bridge, and 232 feet longer than the new London Bridge over the Thames. Its height exceeds that of the New York and Brooklyn Bridge by 16 feet, and that of High Bridge, over the Harlem River, by about 25 feet.

### Fatal Electric Light Accident.

A fatal accident recently occurred at Hatfield House, the residence of the Marquis of Salisbury, to a laborer named William Dimmock, 22 years of age, in consequence of coming in contact with the wires conveying the electric current for lighting the mansion. Hatfield House is lighted with 117 lights on the Brush system, worked by an engine of 16-horse power, placed in the sawmills some distance from the house; two electric wires and a telephone wire connect the sawmills with the house; for some distance they are carried on poles, but to save the unsightly appearance of the poles near the house, the wires are run along the garden wall, three feet from the ground, and for some distance are not protected. The deceased was at work in the garden, assisting to lay a telephone wire, and was sent to ease the wire at the corner of the brickwork to prevent it getting cut. While he was absent the linesman heard the wires shake, and on looking round saw the deceased lying on his back, and on going up to him found he was dead. The machine was at work at the time, some of the Brush Company's men being down from London repairing it, and it is supposed that the deceased slipped, caught hold of the electric wires to save himself, and was immediately killed by the shock. The medical evidence showed that death arose from shock to the system, causing paralysis of the heart. At the inquest the jury returned a verdict that the deceased died through touching the electric wire, and appended a recommendation that there should be a stated time for working the current, and that notice should be given of it to all persons working near the wires.

It was stated that, to avoid similar accidents in future, the wires would all be conveyed either under ground or on poles out of reach.

### Explosion of Aqua Ammoniæ.

The *Pharmaceutical Journal* records a recent case of an explosion of ordinary liquor ammoniæ followed by serious results. A Belfast woman, subject to headache, sent her daughter to the druggist to purchase a small quantity of "head salts," for which he gave her liquor ammoniæ, or "spirit of hartshorn," instead of the salt, carbonate of ammonia. The vial was put on a shelf and not used for a few days. Having a headache, the woman lifted the remedy to apply it, and had it in her hand for a few minutes only when the vial suddenly exploded, scattering the contents over her face. Her eye was destroyed, and her mouth and throat burned, the skin of both having been torn off. The vial had been put on the mantelpiece previous to the time it was used, and when about to apply the contents the woman was sitting near the fire.

### Malarial Organisms in the Blood.

In the blood of patients suffering from malarial poisoning, M. A. Laveran has found parasitic organisms, very definite in form and most remarkable in character. Some were cylindrical curved bodies, pointed at the extremities, with a delicate outline and a transparent body, colorless except for a blackish spot in the middle, due to pigment granules; on the concave side a fine line could often be traced, which seemed to unite the extremities of the crescent. These bodies presented no movement. Spherical organisms were also seen, transparent, of about the diameter of a red blood corpuscle, containing pigment grains which, in a state of rest, were often arranged in a definite circle, but sometimes presented rapid movements, and then lost their regular arrangement. On the borders of the spherules very fine filaments could often be perceived in rapid movement. These filaments were in length three or four times the diameter of a red corpuscle. Their number varied. Sometimes three or four were seen around a spherule, to which they communicated an oscillatory movement, displacing the adjacent red corpuscles. The free extremities of the filaments were slightly reflexed. When at rest the filaments were invisible on account of their tenuity and perfect transparence. These mobile filaments appeared finally by becoming detached from the pigmented spherules, continuing, however, to move freely amidst the corpuscles. There were also bodies of spherical or irregular form, transparent or finely granular, about the hundredth of a micro-millimeter in diameter, containing dark red, rounded pigment grains, either regularly arranged at the periphery, or aggregated at some part of the spherule. The bodies and granules were both motionless. These appear to be the ultimate or "cadaveric" stage of those last described. They have no nuclei, and do not tint with carmine, a distinction from the pigmented leucocytes with which they have hitherto been confounded. Lastly, spherical elements were met with similar to those already described, but much smaller in size, and apparently representing a stage in their development. The animated nature of the mobile pigmented spherule, furnished with filaments, appears indisputable. M. Laveran regards it as a form of animalcule, which exists at first in an encysted state, and in the perfect condition becomes free in the form of mobile filaments, a mode of development not uncommon among the lower organisms. Besides these organisms, the blood of patients suffering from malarial fever contain (1) red corpuscles, which appear to be vacuolated at one or two spots, and contain pigment granules; (2) pigmented leucocytes; (3) free pigment granules, possibly proceeding from the destruction of the parasitical organisms.

These elements were first discovered by M. Laveran a

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year ago, and since then he has examined the blood in 192 patients affected with various symptoms of malarial poisoning, intermittent and continued fever, and palustral cachexia, and found the organisms in 180. The disease had been contracted for the most part in different regions of Algeria and Tunis. He convinced himself, by numerous and repeated observations, that these organisms are not to be found in the blood of persons suffering from diseases that are not of malarial origin. In most of the cases of malaria in which the examination yielded a negative result the patient had undergone a course of treatment with quinine, and to this fact the absence of the organisms from the blood was probably due. The addition of a minute quantity of a dilute solution of sulphate of quinine to a drop of blood was found at once to destroy the organisms. In all the examinations great care was taken to preclude the entrance of any extraneous objects into the drop of blood examined. In general the parasitic bodies were found in the blood only at certain times: a little before, and at the moment of, the accession of the fever. In some very obstinate cases the organisms were always present in the blood. They rapidly disappeared under the influence of a quinine treatment. It is conjectured that in the apyrexial intervals the organisms probably sojourn in internal organs, especially the spleen and the liver. After death from malarial disease pigment granules are found in great numbers in the blood, and especially in the small vessels of the spleen and liver; and they may be, in the most severe cases, so abundant that not only the spleen and liver, but the marrow of bone, and even the gray substance of the brain, are darkened by their presence. These pigment granules, which may obstruct the capillary vessels, appear to be derived from the parasitic elements, which perish after death, and become then unrecognizable. —*Lancet.*

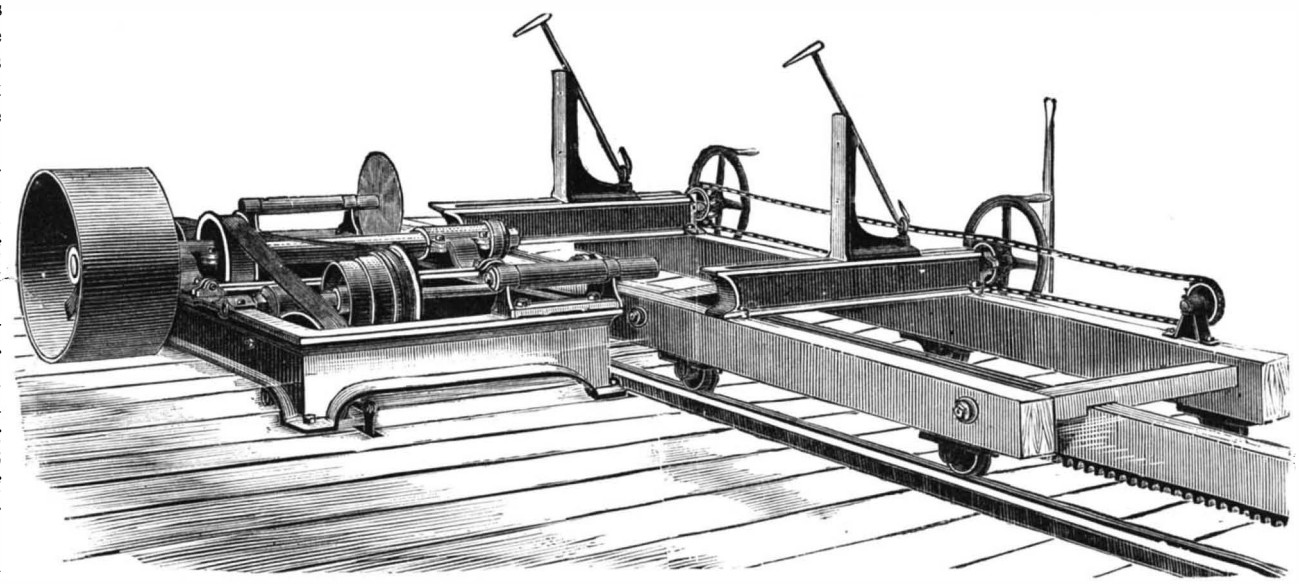
## IMPROVED CIRCULAR SAWMILL.

The circular sawmill shown in the annexed engraving is made at the works of Alexander, Bradley & Dunning, Syracuse, N. Y. The frame is iron, and cast in one piece. The saw mandrel is made of steel, and runs in self-oiling boxes, which are cast in a solid yoke extending across the frame, and is adjusted by means of set screws to line the saw. The main pulley is placed outside of the frame, in order to relieve the bearing next to the saw from the strain of the main belt, and give more room between the saw and belt, greatly increasing convenience and safety in handling the lumber. This mill has an improved friction feed, which may be varied at any point to feed slowly while passing through a knot by pressing with less force upon the feed lever, or the carriage may be instantly stopped by throwing the feed lever over. The sawyer sets the log and operates the carriage, thus saving one man over the old style of mill. These machines are furnished with Carley's improved head blocks with screw or lever set as preferred. The screw set has a patent chain connection and taper attachment, as shown in the engraving, by means of which the screws are operated independently or simultaneously, with perfect exactness, enabling the sawyer to set to any required thickness, with great accuracy, and to advance one or both ends of the log at pleasure, without removing from his place.

When only two head blocks are employed an idle chain wheel and stand is attached to the tail end of the carriage, as shown in the engraving. This enables the sawyer to adjust the second block for long or short logs without detaching the chain; when three blocks are used the third block takes the place of the idle wheel.

An improved simultaneous ratchet set head blocks, with rod connection, can be supplied if desired. They are very simple in construction, and much approved by those who prefer the lever set. The connecting rod is made large to avoid torsion, and is 12 feet long for 18 feet of carriage; 16 feet long for 24 feet of carriage, and 20 feet long for 30 feet of carriage.

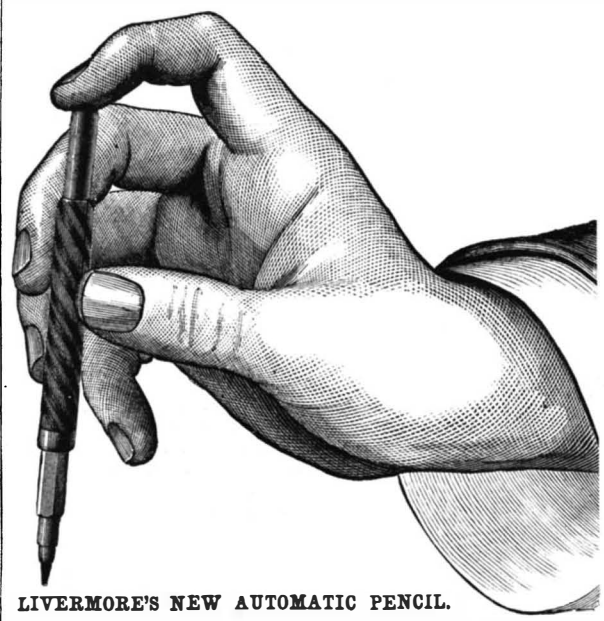
Three sizes of this mill are made, namely, Nos. 1 2, and 3. The No. 1 mill is strong and well made, and runs very light. It is designed for use principally as a portable, in connection with the farm engine for neighborhood use. It is also used in connection with water wheels in localities where water power is limited, and where there is not enough sawing to do to justify the use of a large and more expensive mill. No. 2 is a strong, durable mill, designed to meet the wants of a large class for a good, cheap mill, of larger capacity than No. 1, and is used as a portable or stationary mill. No 3 (shown in the engraving) is used principally as a stationary mill. It has extra heavy iron frame, 3 inch steel saw mandrel with standard collar, and carries a 60 inch or smaller saw. The main pulley is 26 inches in diameter and 14 inch face, and the head blocks open 36 inches; capacity from 10,000 to 15,000 feet per day.



CARLEY'S IMPROVED CIRCULAR SAWMILL.

## NEW AUTOMATIC PENCIL.

The engraving represents a pencil of entirely new construction and of convenient size for the vest pocket. It is handsome in design, well made, strong, and durable. It carries a lead three and three-quarter inches long and three thirty-seconds of an inch in diameter. Leads of this size, black, indelible, or copying, are sold by all stationers, so that the pencil may be readily fitted with leads. The exterior of the instrument is of finely nickel-plated metal and hard rubber, plain or ornamented in various artistic designs. No spiral or other variable spring is used. Unlike other automatic pencils, it has a firm and immovable grasp on the lead that does not cut or mar the lead in the least, and maintains the gripe as long as desired.



LIVERMORE'S NEW AUTOMATIC PENCIL.

When needed for use the lead is advanced by the pressure of the forefinger on the top section; and, when no longer needed, is retired, for protection, by a perpendicular pressure of the pencil on the paper or desk, or by a back-pull of the top section.

When the lead, from wear, requires resetting for a longer point, a quarter turn to the left of the top section releases the gripe, the movable parts are drawn back by the top section, the pencil is then placed, point downward, on the finger or desk, and, while the movable parts are held back, the top section is turned to the right till the gripe is renewed. This automatic operation, requiring but an instant, sets the lead the proper length for use without the aid of the eye.

This instrument is manufactured by the Stylographic Pen Company, and was patented September 13, 1881. It is also covered by Letters Patent in foreign countries, and may be purchased for fifty cents at any of the following offices of the company: 173 Broadway, New York; 290 Washington street, Boston; 38 Madison street, Chicago.

## The Marlboro Sea Serpent.

There was lately discovered in a marl pit in Monmouth County, New Jersey, a notable addition to the known fauna of the ancient sea which overlay that region in cretaceous times. According to Professor Lockwood, the monster was between seventy and eighty feet in length, about one-third of his longitude being a broad, flattish tail constructed of chevron-shaped bones so as to make it a valuable engine of propulsion when used as a scull. The data furnished by the relics would imply that between the tip of his muzzle and the back of his head was a distance of four or five feet. It is possible that the specimen belongs to some undescribed species, but perhaps the remains are too imperfect to decide this. It is certain, however, that it belongs to the genus clidastes, many species of which have been determined, and which have been abundantly found in the West. Clidastes was an own cousin to the mosasaurus, or the great lizard of the River Meuse, described by Cuvier. The European reptile, however, was of a more chunky build, with shorter head and neck and stronger jaws. Both belonged to the order of pythonomorphs or snake-like saurians, which were the genuine sea serpents of the period.

## MECHANICAL INVENTIONS.

Mr. Jacob Burkhart, of Lock Haven, Pa., has patented an improved saw set. This is an improved implement by which the teeth of fine as well as coarse saws may be accurately set, and one which is adapted also to hold and set the teeth of narrow scroll saws. The invention consists principally of an adjustable and slotted rest or support for the saw, of a horizontally adjustable stop or guide in combination with a spring-supported hammer.

Ordinarily pitman bars or rods are connected with the shaft by means of a crank at the end of the shaft, or to cranks formed by bending the shaft. By this arrangement the whole body of the pitman bar is carried with the crank, causing a considerable loss of power and an undesirable jarring or shaking effect, due to the centrifugal force of the pitman bar, and when running at high rates of speed, the centrifugal force of the pitman becomes injurious, causing the whole shaft to vibrate. Mr. George P. Conant, of Geneva Lake, Wis., has patented a pitman bar intended to overcome this difficulty, and also to provide a pitman connection which may be attached to a straight shaft at any point in its length. The invention consists of a pitman head formed with cross slots, in combination with a crank adapted to be secured upon the shaft, the crank pin of which is adapted to move in one of the slots of the pitman head, the other slot thereof being to accommodate the backward-and-forward movement of the pitman and pitman head in a right line upon the shaft, the crank pin being provided with a sliding block, so that the pin will pass the slot for the shaft.

An improved boot-brushing machine has been patented by Mr. Alfred S. Clark, of Chatawa, Miss. The invention consists of a series of brushes attached horizontally and vertically to a frame loosely mounted on a vertical rod and combined with suitable devices for revolving it. The vertical rod is fastened in a base provided with foot-rests, upon which the feet may be placed if the boots or shoes are to be brushed.

An improvement in knitting machines has been patented by Mr. Freeman A. Calley, of New York city. The object of this invention is to facilitate the adjustment of the length of the stitch; to facilitate running a series of needles out of operation, and, finally, to prevent breaking the vertical ribs of the stationary needle-carrying cylinder. These ends are attained by an ingenious combination of mechanism which cannot be clearly described without engravings.

Mr. Henry G. Dennis, of New Bedford, Mass., has patented an improved bell joint for coupling pipes which consists in a beveled or bell-shaped collar provided in the inner surface with a groove or rabbet a short distance from each mouth of the collar. The latter is mounted on the enlarged or swaged end of a pipe, which receives the contracted end of another pipe. The rabbets of the collar are then filled with molten lead or other suitable filling and thoroughly driven.

An improved spring, particularly adapted for side bar buggies, has been patented by Mr. James H. Howe, of Conneaut, O. These springs are long, yet they occupy small compass in the buggy, thus making the buggy very easy riding, and a buggy provided with these springs will carry one or more persons with equal ease and comfort.

Mr. Parsons Shaw, of Manchester, County of Lancaster, England, has patented an improvement in dental engines. The main object of the invention is to improve the universal joint employed in dental engines by a hinge movement which will allow the swinging arm to play freely in any direction without straining the spiral transmitter or causing it to bind or buckle. This is accomplished by using bifurcations on the bearings and bending their ends at right angles to the bearings, then connecting these ends by pivots.

In the manufacture of cotton goods the marks called "cut marks," which indicate "pieces" or "cuts" of forty, fifty, sixty, or more yards, are put upon the warp in the process of dressing or sizing the same, usually by means of a roller (which has interchangeable large and small gear wheels) placed in the slasher near the measuring wheel, which roller carries a block from a trough or box containing coloring material slowly upward to a point where, at the proper time, it rolls against the warp, leaving the cut-mark, and from thence falls back into the color box. Mr. Orrin M. Rolfe, of Lowell, Mass., has patented a cut-marker for slashers which will deliver the mark suddenly, as by a blow, and then cause the brush to move down into the color box with

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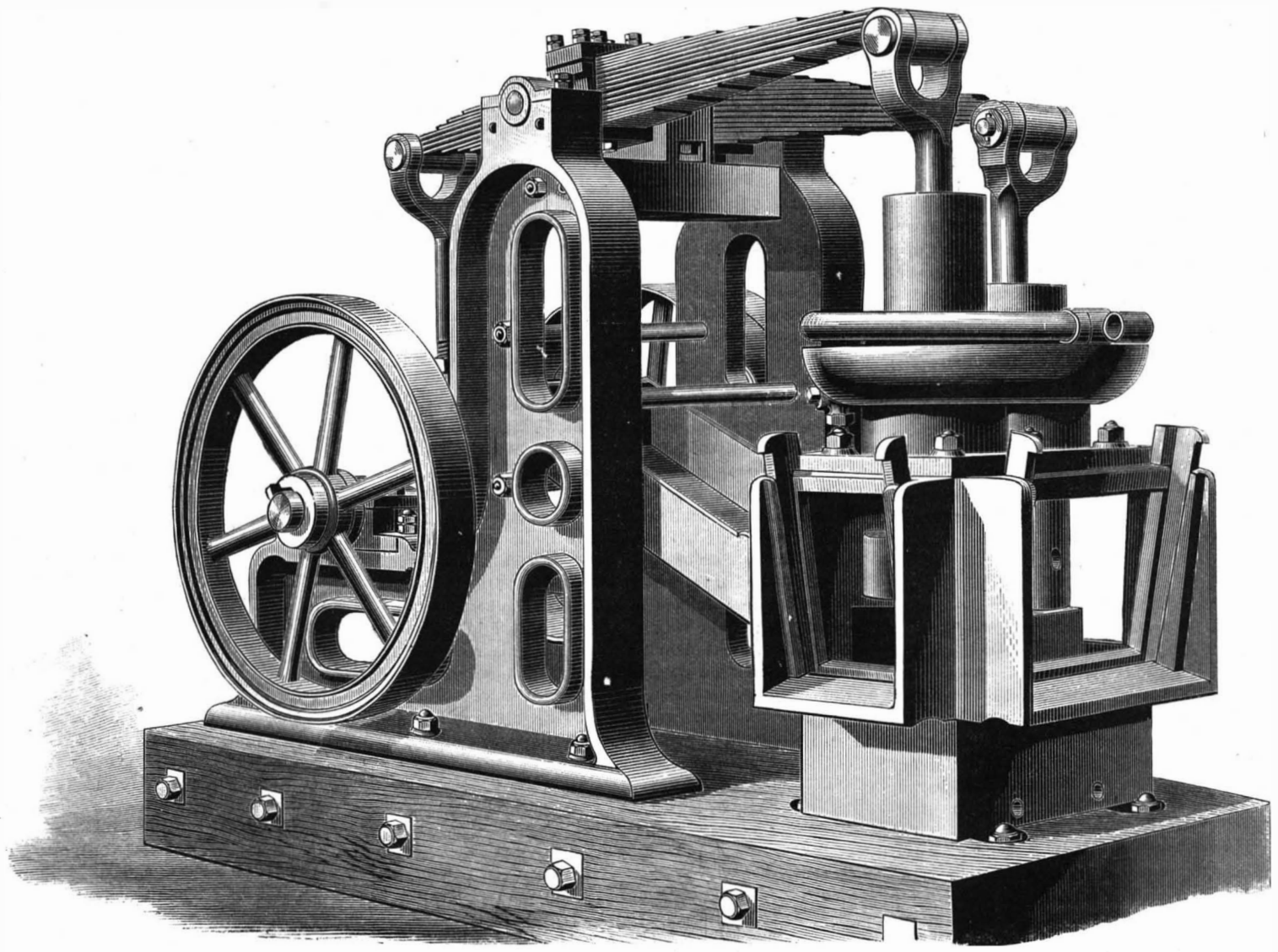
a slow, steady movement, which will not cause the coloring material to be splashed upon the warp. This invention consists of a cut-maker having such construction as to impart to the marking brush an accelerated or stroke motion at that portion only of its revolution around the shaft where it comes in contact with the warp.

An improved support for holding clockworks, to facilitate adjusting, cleaning, and repairing, has been patented by Mr. Johann J. Vossler, of New York city. The invention consists in a standard mounted on a suitable base and containing a loose rod passing longitudinally through it, and provided at its upper end with a hook for holding the clockwork on the top of the standard, and at its lower threaded end with a winged nut for drawing the hook up tightly against the crossbar of the clockwork frame on which this hook catches.

### IMPROVED QUARTZ STAMPER.

We give an engraving of a gold quartz stamp in which the principle of the spring hammer is applied. This stamper is intended as a substitute for the "cam and wiper" stamps, of which full descriptions have been given in our pages, and its chief feature consists in the employment of two plate springs balancing each other, these springs being mounted on bearings placed in rear of the center of their length, and being driven at the short ends by connecting rods (whose length is adjusted to the wear of the shoes), driving shaft, and pulley, in the usual manner.



DUNHAM'S GOLD QUARTZ STAMPER.

Attached to the long arms of the springs are suspended cast-steel tupps with forged and tempered steel shoes striking elastic blows on the quartz, it being claimed that such elastic blows have the effect of reducing sliming, and thoroughly separating the particles of gold from the pyrites without foliation. The machine is perfectly balanced, and when operating on some qualities of quartz each "head" can be run with advantage at 300 blows per minute, although the blow can be varied at will, accommodating itself to the quality of the quartz under the hammers. It will be seen that the elastic blow desired is obtained without complication or multiplication of parts. The total weight of the machine is 1⅜ tons, or very little more than half the weight of any ordinary stamper now in use, while the heaviest of the subdivided parts when being taken across country is less than 3½ cwt. There are no pistons, stuffing boxes, or valves, nor in fact anything that cannot be repaired in camp, duplicates of a few of the parts being supplied for machines going abroad. The machine we illustrate has been constructed by Messrs. I. Copley & Co., of Middlesbrough, England. One of these machines is now in London, and we are informed it will be stamping hard Welsh gold quartz at a wharf on the Thames within a few weeks, when we hope to be able to give particulars of its performance. So much attention has recently been paid to the reduction of gold quartz that the performance of the Dunham stamper will be watched with great interest.—*Engineering.*

### Arctic Temperatures.

Recently Mr. George Kennan, in a letter to the *Herald*, questioned the accuracy of the thermometers used by the Schwatka Expedition, and argued that the low temperatures recorded by them could not be accepted as trustworthy. He was promptly met by a citation from the *Herald* of October 6, 1880, in which he said:

"Seventy-one degrees below zero, which is Lieutenant Schwatka's lowest observation, is not especially remarkable. There are officially recorded observations of —76 degrees at Yakutsk, in Northeastern Asia, and records of —70 degrees are comparatively common in various parts of the Arctic regions. We experienced a temperature of —68½ degrees on the plains between the Okhotsk Sea and the Anadyr River in 1866."

The writer proceeds to compare the records made by Schwatka's party with the records for corresponding dates in several parts of the Northwest. For example, the former report the mean temperature for December, 1879, at —50·4 Fahrenheit, the lowest —69, and the highest —26 degrees. On December 23 the temperature at Pembina was —35, and at Fort Garry —30. On the 24th, at St. Vincent's, it was —58, at Crookston —56, at Grand Forks —50, and at Breckenridge —39 degrees. During the months of December, January, and February the temperature was but seldom above zero, and on many occasions it was more than 35 below. If the difference of latitude (15 degrees) between the above-mentioned stations and Schwatka's position be considered, Mr. Kennan's opponent remarks, it is not difficult to understand why such low temperatures were encountered.

It is now claimed that the coldest place on the earth is not, as has hitherto been believed by meteorologists, Yakutsk, in Siberia, but Verkoyansk, in the same region, lying in 67½ degrees north latitude, on the river Yana. Its lowest mean winter temperature is 48·6 degrees below zero Centigrade, or —55·48 degrees Fah. This is the cold pole of the earth in Asia, the corresponding pole in America being to the northwest of the Parry Islands.

### Proposed Uniform Time Service.

The Signal Service authorities have planned an extension of time service, in this and other Atlantic ports, which promises to have some far-reaching results. Nearly all the vessels engaged in the Atlantic trade regulate their time by the Greenwich standard, which from the vast predominance of the British marine is becoming the conventional standard the world over. To facilitate the testing and regulation of ships' chronometers in our port it is now proposed to set up a time-ball on the high building of the Equitable Insurance Company, to be dropped hourly by Greenwich time. It is also in contemplation to establish a system of standard meridians at even-hour distances from Greenwich, and the distribution of standard time based thereon in allour principal cities.

The meridian five hours (or 75°) from Greenwich passes near Philadelphia. The proposition is (by disregarding the odd minutes) to make Philadelphia time officially five hours later than Greenwich time, and the standard for the Eastern and Middle States. It is reasonably held that to the 12,000,000 people within twelve minutes of the Philadelphia meridian the practical convenience of uniform time will vastly outweigh the theoretical inconvenience of having their time uniformly a few minutes too fast or too slow. The next standard hour line would fall near the meridian of St. Louis, Memphis, and New Orleans, making the time of the Mississippi Valley exactly one hour later than that of the East. Two other hour lines would cross the country near Denver, Colorada, and near San Francisco, California. This would give four standards for the whole country, instead of the forty now existing.

### The First American Arctic Colony.

Dr. Octave Pavy, U.S.A., who went to Greenland on the Gulnare, in 1880, and joined the expedition under Lieut. Greeley, as surgeon and naturalist, on its arrival at Godhaven in July last, has written to friends in St. Louis giving an account of the planting of the first signal station at Discovery Harbor. On the passage from Godhaven to Lady Franklin Bay, Dr. Pavy and Lieutenants Greeley and Lockwood went ashore at the Cary Island and visited the depot of provisions placed there by Captain (now Sir George) Nares, of the English expedition, in 1875. At Life-boat Cove, where Buddington and part of the Polaris party passed their second winter after the death of Captain Hall, they found several relics of the Polaris camp and sent them to some of the party now in Washington. Cape Hawks and Washington Survey Island were also visited, and the depots established by Capt. Nares inspected. At the latter place Lieutenant Lockwood made a copy of the record left by Captain Nares, which he left in the cavern and brought the original away. At Cape Lieber they went ashore and climbed the cliff, which is about 2,500 feet high, and had a magnificent view from it—Polaris Promontory, Peterman's Fiord, Lady Franklin Bay, and Bessett's Bay all lying like a panorama before them. It was from this high cliff that Dr Hayes saw the open Polar Sea. Prior to the arrival of the Proteus at Godhaven Dr. Pavy had a large quantity of the best fur clothing made, and procured other necessary articles for the sledge parties, which will make explorations from Ft. Conger northward towards the Pole. This station is in latitude 81 deg. 44 min., and longitude 64 deg. 45 min. west.

Another American signal station, it will be remembered, was planted last summer at Point Barrow, Alaska. Russia has just sent a party to the mouth of the Lena, Siberia, to plant a similar station there. The other international Arctic stations projected are as follows: By Austria, one station at Jan Mayen Island; by England, one station at Fort Simpson; by France, one station at Spitzbergen; by Germany, two stations, one on the Gulf of Georgia, the other at a place not yet decided upon, in the region of the North Pole; by Denmark, one station on the western coast of Greenland; by Norway, one station at Altengaard, in the province of Finnmark.

### A Corn Crusher Wanted.

A Louisiana sugar planter writes us that there is great need in the South for a machine that will crush or grind unshucked ears of corn, as they come from the field, into a coarse meal of corn, cob, and husks, and do it rapidly. He is aware that there is a machine that will crush corn in the ear thoroughly, one ear at a time; what he wants is something that will receive a bushel of ears or nubbins at once, and crush, say, twenty bushels an hour. One of the great troubles of sugar planters, he says, is the preparation of food for their mules. To crush corn in the ear with existing appliances, the corn has to be husked, costing much labor, and there is apt to be great loss of small ears. "A fortune awaits the inventor of a machine to crush by the wholesale corn, cob, and shucks together." The problem does not seem to be a difficult one, and some of our inventive readers may find it profitable to undertake its solution.

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## ENGINEERING INVENTIONS.

Mr. Charles W. Rasmusen, of Chicago, Ill., has patented an improvement in the class of street railways in which the cars are propelled by means of endless traveling wire ropes or cables arranged in a tube or tubular center rail (laid between the ordinary track or running rails) and passing around rotating drums located at the respective ends of the road, or at points which are at less distance apart. The improvements pertain to the combination of tubular center rail, the trucks that carry the traction cables, and the device attached to the car and adapted to lock with the trucks to cause propulsion of the car.

Mr. Edwin T. Pettit, of Marshalltown, Iowa, has patented an improved air pump for forcing and compressing air, the object being to furnish a machine by which a continuous stream of air can be forced through a pipe or into a receiver. It consists of two sets of single-acting cylinders, a series of direct-acting piston rods, with plungers at each end, and a series of driving cranks fitted to reciprocate the pistons. The pump has no inlet valve, each plunger being withdrawn from its cylinder to admit the air.

An improved car coupling has been patented by Mr. James W. Hancock, of Union, Ky. This invention relates to what are called "self-couplers," and it consists of draw-heads with flaring and projecting sides and lower lips provided with vertical swinging pendants and transverse coupling pins and of a coupling link, consisting of a flat bar of metal bent downward in the center and having its ends curved or turned downward, to clasp or engage on the coupling pins.

An improved wicket and caisson for movable dams has been patented by Mr. William H. Dechant, of Reading, Pa. The object of the invention is to facilitate the work of construction and repair in connection with such dams; and the invention consists in the wickets for the dams and their connections to the bed, and in a movable caisson by which convenient access can be had to the wickets. The wickets may be used in rivers, canals, and other water-ways for deepening channels and for improvement of slack-water navigation.

An improvement in stamp mills has been patented by Mr. James M. McFarland, of Virginia City, Nev. The object of this invention is to provide a device by which stamps may be run with greater speed, greater crushing force, and less liability to injury or wear of working parts. The invention consists of a separate cam shaft with single-armed cam or cams for forcing the stamps down, and of elastic or spring cams for obviating the usual shock or jar that obtains when an inelastic cam comes in contact with a stamp tappet.

An improvement in car couplings has been patented by Mr. William L. Fisher, of South Saginaw, Mich. The object of this invention is to provide an improved car coupling device which is adapted to use the ordinary forms of coupling pin and link within a chambered draw head, and to provide means whereby the coupling pin is upheld, and is released automatically to couple the cars on the entrance of the coupling link, which is held in a horizontal position and is always protected from injury.

An improved railway rail has been patented by Mr. Henry A. Fletcher, of Lowca Engine Works, near Whitehaven, County of Cumberland, England. This improvement relates to rails used for the permanent way of railways and tramways, and is designed to obtain more solid and firm support to the rails without materially increasing the material. The invention consists in an improved form of base or lower flange for the rail, it being extended or spread out where it rests upon the sleeper or other support, instead of being made, as usual, of a parallel form throughout.

Mr. Theodore F. Odell, of Nyack, N. Y., has patented a device for propelling vessels which will utilize the power much more economically than the devices in use for the same purpose heretofore. The invention consists of a series of paddles attached to the lower edges of frames loosely mounted on the edges of eccentric wheels mounted on a shaft and projecting in opposite directions, which frames have an upper arm connected with a rigid frame by a pivoted rod, so that if the shaft is rotated the paddles will describe a segmental curve in the water, will be raised and describe a segmental curve in the air in opposite direction, and will dip in the water and describe the same segmental curve in the water, and so on, thereby propelling the vessel.

### The Acetate of Soda Stove.

Two methods of utilizing acetate of soda for warming purposes are before the public: the original invention of M. Ancelin, in which acetate of soda alone is used, and a modification recently patented by Herr A. Nieske, a chemist of Dresden. The *English Mechanic* says that the former has been taken up by the London and Northwestern Railway Company, who have a license for three thousand foot warmers, but according to the statements made, the invention of Herr Nieske is in some respects superior. It appears that two of the soda salts are peculiarly adapted to the purpose, namely, the hyposulphite and the acetate. The first-named salt has the property of melting easier than the latter, consequently, when the hyposulphite of soda is mixed with acetate of soda, the former prevents the latter from crystallizing too rapidly. The two salts combine and form a permanent filling, so that the reservoirs, vessels, or receptacles containing the same can be soldered down, and thus hermetically closed. Herr Nieske has found it preferable to employ the following proportion of the salts: one part hyposulphite of soda to ten parts acetate of soda. The reservoirs or receptacles are filled to about three parts full, and the lid soldered on. In order to prepare the reservoirs for employment they are placed in boiling water until the filling is melted; this is readily ascertained by shaking the reservoir or vessel, which can be modified in form according to the purpose for which it is used.

Fig. 1 is a vertical section, and Fig. 2 a horizontal section of a "stove" which is suited for employment in bedrooms, sick rooms, offices, dwelling and other rooms. The stove is placed on three or more feet with casters, so as to enable

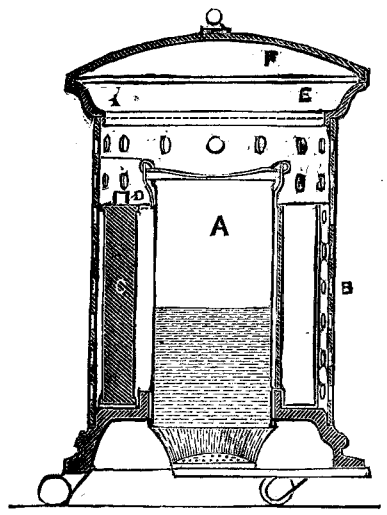


Fig. 1.

it to be easily transported from one place to another. A is a vessel of cylindrical or other suitable form; B is a perforated mantle forming the outer walls of the stove. The reservoirs, C, filled with the soda salts above named, are arranged between the vessel, A, and the perforated mantle, B, of the stove. They are of such size that they can be inserted in the central vessel, A, by means of their handles, D. The stove is closed by the cap, E, and lid, F, which can be readily removed. The water in the vessel, A, can be brought to a boiling point by means of a burner in connection with a gas pipe.

As soon as the water in the vessel, A, has been brought up to the boiling point, the reservoirs, C, which contain the soda salts, are inserted in A, until the salts contained in them are melted. The reservoirs are then replaced in their former position between cylinder and mantle, and emit the heat they contain so gradually and equably that the filling even after a lapse of from ten to twelve hours is found to be warm. The cylinder or vessel, A, can be entirely removed from the stove, and the reservoirs heated, or the soda salts contained in the same melted in any suitable boiler or similar receptacle; or the vessel, C, can be heated in any other suitable place. The cylindrical vessel, A, is for this purpose provided with a projecting ring or flange, which lies on three supports or brackets, which also serve to support the reservoir, C. The evaporation of the water in the vessel, A, prevents the air in the room becoming too dry. For

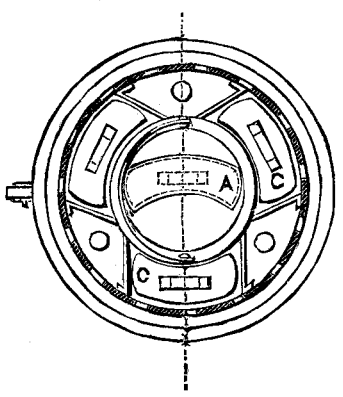


Fig. 2.

foot-warmers, tubing or pipes run through the filling so as to attain a greater surface for the emission of warmth; such foot-warmers retain their warming properties for about twelve hours. Stomach, chest, and other warmers can be employed with the same filling, and are adapted for employment in hospitals, sick rooms, and such like. The warmth emitted by these reservoirs is especially beneficial to patients, as the heat remains equable, continues for several hours, and is not only agreeable but beneficial. Another application to which this class of warmth reservoir can be put is to place the same within a nickeled or other suitable ball, which can be easily carried in a muff, overcoat, etc., and can be held in the hand when skating, riding, driving, walking, and so on, in cold weather. They can also be most advantageously employed for artificial breeding apparatus or incubators, as the warmth remains continuously the same, and is therefore the best substitute for the natural warmth of the blood.

### The Weakness of the Large Groined Vault in the Assembly Chamber of the New Capitol at Albany.

When the crack first appeared in the large vault of the Assembly Chamber at Albany, the trouble was supposed to arise from the yielding of the clayey earth upon which the Capitol stands. Combating the theory that there was danger of a sliding of the entire building down the hill upon which it stands, Mr. Wm. J. McAlpine, the engineer in charge of the earlier foundation work, expressed the opinion that the crack was due to an unequal settlement of the walls. He said: "The four walls of the Assembly Chamber respectively were intended to carry loads of 60, 47, 23, 18 tons, and the foundation walls were built out accordingly. This arrangement was on the idea that these walls would carry the ceiling of the room. When it was determined by the later architect to have a stone ceiling, and to support it upon columns independent of the outer walls, everything was altered. The foundations of these columns must hit upon the outer edge of the footing course of the wall, and they do the damage." Another theory was that the arch had been warped by unequal loading.

The subject has more recently been investigated by Mr. H. W. Fabian, who enters into an elaborate calculation, in the *American Architect*, to demonstrate an inherent weakness in the whole vault due to faulty construction. He finds that to enable the columns to withstand the great thrust of the arches and ribs of the central vault a method of construction has been employed which must in time lead to downfall of the entire structure. Immediately over the principal arches of the square corner vaults great half arches, not visible, have been raised, whose skew-backs continually press against the columns. The half arches are held together at the top by iron tie rods, which run through the wall above the great principal arches, connecting one half arch with another; a dangerous device owing to the unequal expansion and contraction of the iron and stone by variations in temperature, a perpetual cause of disintegration. The work of destruction Mr. Fabian finds to be hastened by radical faults in the moulding of the ribs of the vault, so that sooner or later a wider destruction of the ribs, and consequently of the whole vault, will take place. Absolute security against such a disaster can be obtained, he asserts, only by tearing down the whole vault and building another in its place.

## Correspondence.

### Intelligence of Dogs.

*To the Editor of the Scientific American:*

In the SCIENTIFIC AMERICAN of December 17, I notice a dog story, which prompts me to relate another, showing the wonderful sagacity of that animal.

While at the university taking my medical course the facts I relate took place. Among other appurtenances to the department of physiological chemistry was a dog with a gastric fistula, which fistula was properly healed around a silver tube having an internal and external flange to keep it in place. The tube was stopped by a closely fitted cork, except at such times as we needed a supply of gastric juice. The fistula caused the animal no disturbance whatever. He was well and hearty, was fed at and made his home at the medical department.

During the summer vacation, however, when the university was closed, he was transferred to the care of the surgeon, who took him to his house. During his frolics one day he jumped over a fence, striking it, and dislodged the cork in the tube. Ponto soon noticed that his food didn't seem to satisfy him, and that all he drank ran out of his stomach on the ground. His master having gone away for several days—fishing—he must needs take care of himself, so *immediately* on eating or drinking anything, he ran to his bed in the carriage house close by, *turned on his back, and remained so for an hour* or more, or until he felt satisfied that it would do for him to get up. Coaxing, threatening, and kicking by the domestics about the house, or by those whose attention was called to his actions, were alike unavailing to drive him from his place or from his supine position. Finally, some one who knew for what purposes the dog was used, examined his fistula and found the cork gone. This being restored, he was soon persuaded to go about as usual, and indicated by his actions that he understood that everything was all right. This incident can be vouched for by many reliable persons. Who will say that dogs—at least one dog—cannot reason? F. L. BARDEEN, M.D.

Rochester, N. Y., December 23, 1881.

### Mr. Lawson's Boiler Experiment.

*To the Editor of the Scientific American:*

Reading your article on the boiler experiments of D. T. Lawson, Wellsville, O., I was reminded of the following old one: Boil water in a closed glass vessel. When the steam formed inside gets above the pressure of some atmospheres *it will arrest the boiling.* Then pour some cold water on the outside. The steam is partly condensed, the pressure removed, and ebullition recommences. This paradoxical experiment has always been explained on Mr. Lawson's doctrine that removing pressure causes the heated water to burst suddenly into steam. I imagine the glass globe arrangement might be advantageously used to confirm or refute his further opinion that the effect of the concussion is greater than the regular steam pressure.

Eau Claire, Wis., 1882. C. L. JAMES.

### California Trout Eggs for Distribution.

The New York State Fish Commission will send any parties wishing to experiment in fish culture from 300 to 500 eggs of the California mountain trout, on receipt of fifty cents to pay for the package. This species is very hardy, and a valuable game and food fish. Applications must be made before March 1, 1882, to Seth Green, Rochester, N. Y.

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## NEW INVENTIONS.

A novel gas and electric lamp fixture has been patented by Messrs. George Crosby, of New York city, and Edwin M. Fox, of Brooklyn, N. Y. The object of this invention is to provide a fixture which shall be equally applicable to the use of gas or the electric light. A device of this kind is a great desideratum in this new era of the electric light, for the reason that consumers can have the satisfaction of knowing, after testing the electric light, that if they desire to go back to the use of gas again they can do so without any additional expense involved in a further change of fixtures. Moreover, this device enables the consumer to use at will either gas or electric light, with little or no change in the adjustment of the parts, and with no more complicated manipulation than that ordinarily required for gas. The invention consists in providing an ordinary gas bracket or pipe with two circuit wires carried within the pipe, and providing at the gas cock such connections and insulations that the current shall be cut off when the cock is turned in one direction, and turned on when the cock is turned in the other direction, without interfering with the turning off or on of the gas through the same cock.

An improved steam grain drier has been patented by Mr. Henry Coker, of Indianapolis, Ind. This invention consists of one, two, or more cylinders placed one above the other and inclined in opposite directions, the lower end of each upper cylinder being over the upper end of the next lower cylinder, so that the grain can be conducted from the lower end of each upper cylinder into the upper end of the next lower cylinder. Within each cylinder, and concentric therewith, is placed a steam-tight hollow cylinder made of sheet iron or other suitable material. The inner cylinder is made longer than the outer cylinder, and projects at both ends, so that the projecting ends can be attached to the frames by which the cylinders are supported. With this construction the inner cylinders are stationary, and the material to be dried is in the space between the inner and outer cylinders, and is continually being raised by the buckets of the outer cylinder and being poured in a shower upon the inner heated cylinder.

Domestic animals are apt to get themselves cruelly lacerated by coming violently against the barbs of ordinary wire fences, which barbs are always rigid (usually formed of a single piece of metal) and rigidly secured upon the strands of the fence. Mr. William W. Butler, of Boise City, Idaho Ter., has patented an improvement in fence barbs which overcomes this difficulty. The invention consists in providing a yielding barb to be attached in any desired position and by any suitable means to the strands or bars of the fence.

An improved keyhole guard has been patented by Mr. Alwill E. Voos, of New York city. The object of this invention is to prevent locks for doors and other places from being picked. The protector can be attached to either the outside of the door or the inside, as circumstances may require. When the protector is attached to the inside of a door the guard prevents any access to the lock through the keyhole upon the outside of the door.

An improvement in underground conduit for telegraph conductors has been patented by Mr. Seth E. Codding, of New Bedford, Mass. This is an improvement upon the method described in Letters Patent granted to the same inventor August 24, 1880, which consisted, essentially, in manufacturing such conduits in a box or trench, with concrete or cement around a mandrel or core moved progressively. The object of the present invention is to obtain more complete insulation of the conduits; and it consists in hollow mandrels prepared from paper coated and saturated with suitable material, which mandrels are laid in concrete and cement and left therein to form the conduit.

An improvement in force pumps has been patented by Mr. Henry H. Hunter, of Millersburg, Ky. The invention consists in the combination, with a vertical pump provided with a horizontal extension or discharge pipe, of a receiving box or chamber provided with a vertical discharge pipe, and secured over the valved opening of the horizontal extension discharge pipe. There is a foot projecting below the pump cylinder for the purpose of holding it above the bottom of a well or cistern.

An improved shoe button and fastener has been patented by Messrs. Philander Burr and William H. Mercer, of Worthington, Ind. The invention consists, principally, of a screw cap provided with an eye for holding a button, the screw cap being adapted to be secured to the shoe by a screw bolt. The button used in connection with this device has a concave bottom, in which the eye of the button is placed.

Mr. William McNaught, Jr., of Cartersville, Ga., has patented an improved girth for side saddles which can be tightened, as circumstances may require, by the rider without leaving the saddle. It consists in a girth composed of two sections, united at two adjoining ends by straps and buckles, whereas the other ends overlap each other, one end sliding on the other, and both are provided with pulleys, over which a rope or strap passes which is fastened to the end of the sliding band and terminates in a ring which is hooked on hooks on the fixed band above the pulley of this band.

An improved coffee cleaner and grader has been patented by Mr. Elam Rakestraw, of Cambridgeport, Mass. The invention consists in an ingenious combination of mechanism, whereby the whole berries and the broken and imperfect berries can be separated from each other and from impurities; also in mechanism whereby the whole berries and the broken and imperfect berries can be subjected to separate air blasts at the same time.

Mr. Hiram H. Ward, of Packwaukee, Wis., has patented a novel burglar alarm. The invention consists in a guard for a door or window formed of a cord or wire that is alternately passed over rollers on a bar rigidly attached to one side of the casing of the door or window, and over rollers on a movable bar held by staples to the opposite side of the casing, so that the cord or wire crosses the opening of the door or window casing several times. This movable bar is connected by cords or wires with a pivoted rod or lever, which is turned or tilted by springs acting upon it as soon as the cords connecting with the movable bar on the window casing are cut or strained, thus causing cams on this lever to raise another lever, whereby a ratchet wheel acted upon by a clock spring or weight is released and rotated and vibrates a hammer that strikes a gong.

An improved wardrobe bedstead has been patented by Mr. Daniel H. Wheeler, of Brooklyn, N. Y. The object of this improvement in bedsteads is to obtain closet room convenient of access, whether the bed be up or down and to secure projection of the bed, when turned down, entirely beyond the inclosing stand or case.

## Areas of the United States and Territories.

The geographer of the Tenth Census has made a careful revision of the areas of the several States and Territories, the figures heretofore given by different authorities showing great discrepancies and manifest variations from truth. In fourteen States and five Territories the revised areas are less than those given in the census of 1870; in the rest they are greater. The reduction for California is over 30,000 square miles. Excluding Alaska (the area of which is probably between 550,000 and 600,000 square miles), the new areas make the aggregate for the entire country about 900 square miles less than the estimate made ten years ago. The new figures are as follows:

| | Gross Areas. | Total Water Surface. | Total Land Surface. |
|---|---|---|---|
| Alabama | 52,250 | 710 | 51,540 |
| Arizona | 113,020 | 100 | 112,920 |
| Arkansas | 53,850 | 805 | 53,045 |
| California | 158,360 | 2,380 | 155,980 |
| Colorado | 108,925 | 280 | 108,645 |
| Connecticut | 4,900 | 145 | 4,845 |
| Dakota | 149,100 | 1,400 | 147,700 |
| Delaware | 2,050 | 90 | 1,960 |
| District of Columbia | 70 | 10 | 60 |
| Florida | 58,680 | 4,440 | 54,420 |
| Georgia | 59,475 | 495 | 58,980 |
| Idaho | 84,800 | 510 | 84,290 |
| Illinois | 56,650 | 650 | 56,000 |
| Indiana | 36,350 | 440 | 35,910 |
| Indian Territory | 64,690 | 680 | 64,090 |
| Iowa | 56,025 | 550 | 55,475 |
| Kansas | 82,080 | 380 | 81,700 |
| Kentucky | 40,400 | 400 | 40,000 |
| Louisiana | 48,720 | 3,300 | 45,420 |
| Maine | 33,040 | 3,145 | 29,895 |
| Maryland | 12,210 | 2,350 | 9,860 |
| Massachusetts | 8,315 | 275 | 8,040 |
| Michigan | 58,915 | 1,485 | 57,430 |
| Minnesota | 83,365 | 4,160 | 79,205 |
| Mississippi | 46,810 | 470 | 46,340 |
| Missouri | 69,415 | 680 | 68,735 |
| Montana | 146,080 | 770 | 145,310 |
| Nebraska | 76,855 | 670 | 76,185 |
| Nevada | 110,700 | 960 | 109,740 |
| New Hampshire | 9,305 | 300 | 9,005 |
| New Jersey | 7,815 | 360 | 7,455 |
| New Mexico | 122,580 | 120 | 122,460 |
| New York | 49,170 | 1,550 | 47,620 |
| North Carolina | 52,250 | 3,670 | 48,530 |
| Ohio | 41,060 | 300 | 40,760 |
| Oregon | 96,030 | 1,470 | 94,560 |
| Pennsylvania | 45,215 | 230 | 44,985 |
| Rhode Island | 1,250 | 165 | 1,085 |
| South Carolina | 30,570 | 400 | 30,170 |
| Tennessee | 42,050 | 300 | 41,750 |
| Texas | 265,780 | 3,490 | 262,290 |
| Utah | 84,970 | 2,780 | 82,190 |
| Vermont | 9,565 | 430 | 9,135 |
| Virginia | 42,450 | 2,325 | 40,125 |
| Washington | 69,180 | 2,300 | 66,880 |
| West Virginia | 24,780 | 135 | 24,645 |
| Wisconsin | 56,040 | 1,590 | 54,450 |
| Wyoming | 97,890 | 315 | 97,575 |
| Unorganized territory | 5,740 | — | 5,740 |
| Delaware Bay | 620 | 620 | — |
| Raritan Bay and lower New York Bay | 100 | 100 | — |
| Total | 3,025,600 | 55,600 | 2,970,000 |

## A Great City of Cliff Dwellers.

During the past season a remarkable discovery of an ancient cliff city, 60 miles long, was made by Mr. James Stevenson, the leader of the Archæological Exploring Expedition to New Mexico and Arizona, under the direction of the Smithsonian Institution. Mr. Stephenson tells the *Tribune* that for 60 miles along the face of a winding cliff, except where the elements had cut them away, the cañon walls had been carved out like swallows' nests, and the cave dwellings extended two, three, four, and sometimes five rows, one above another.

Mr. Stephenson examined this deserted city during several days, personally visiting portions distant 45 miles from each other, and discovering with his glass that the excavations extended 15 or 20 miles further on. By far the greater number are inaccessible, but many of the old paths, worn many inches deep by the feet of the ancients who dwelt there, are intact, and by them the explorer mounted to the old dwellings. There was a marked similarity in the form and construction of these excavations. There was only one aperture, which served for door, window, and chimney. The single room had an oval roof, which bore the grooves made by the flinty adzes or axes of the excavators. The method of digging or carving out these caves was disclosed by the form and direction of the grooves, which were usually parallel to each other, and several inches apart, while between, as shown by the rough surface of the stone, the remaining substance had been broken off. There were fireplaces at the rear, but no place of exit for the smoke except the single aperture in front. Many of the dwellings had side or rear excavations of small size, within some of which corncobs and beans were found, evidently left by chance inhabitants of a later period. Near the roof of many of the caves there were mortices, projecting from which in some instances there were discovered the decayed ends of wooden sleepers. These were of a kind of wood not recognizable as a present growth of the locality and unknown to the explorers. Specimens were brought away to be examined and classified by naturalists. In the sides of some dwellings there were found small recesses, evidently used as cupboards for the household utensils of the family. The substance of the cliff was tufa, a volcanic ash quite soft and easily worked by the rude implements of the old builders.

Upon the top of the Mesa or tableland above these caves there were found large circular structures, now in ruins but with walls to the height of ten or twelve feet still standing. They were evidently places of worship. They were built of square stones of nearly uniform size, about twenty inches in length by six inches in width and four in thickness, cut from the cliff. Measurements were made of two of these structures, one of which was 100 and the other 200 feet in diameter, and might have held from 1,000 to 2,000 people. The inference that these were places of worship is drawn from the fact that the Pueblos of the present day, who are fire and sun worshipers, have similar temples. No remains of altars were found, which fact is doubtless to be explained by the exposed situation and the soft materials probably used in the construction of such furniture. The southern end of this cave city, which seemed to have been the most densely populated, presented many evidences of art and industry. This locality is more broken, and offers a better chance for successful resistance to the assaults of an enemy. There were found many animal forms carved out of stone. In one place there were two life-sized mountain lions, animals which are still peculiar to that region. There are also to be seen many smaller animal forms, so much worn away that it cannot be determined what they were designed to represent. Upon standing walls in this neighborhood are many hieroglyphics, which from their resemblance to the picture writing of the living Pueblos, may, Mr. Stephenson thinks, be partially, if not entirely, deciphered. The great age of this city is proved by the vast accumulation of *dêbris* from the upper portion of the cliff, which covers its base. In places where mountain brooks have cut their way through, the existence of one and sometimes two rows of cave dwellings below the surface of the *dêbris* is disclosed. Mr. Stevenson thinks that several centuries have passed since this dead city was in its prime.

## About the Leitchfield Cave.

A copy of the *Grayson Advocate*, published at Leitchfield, Ky., was sent to us about a month ago, together with a letter written by Mr. Joseph Mulhatten, of Louisville, with the expectation that some notice would be taken of their contents. They profess to describe a large cavern with immense halls, rivers swarming with blind fish, a great pyramid, a Masonic altar, sarcophagi covered with Masonic emblems, and containing mummies, two of which the letter writer claims to have now in his possession. This story, with variations, has since appeared in several respectable newspapers, and it is time to let the public know that the whole statement is a fabrication.

One of the persons mentioned as having explored the depths of this cavern is Mr. John E. Stone, a surveyor, by whose careful measurement it was said to have been found that the main avenue was fourteen miles long! Mr. Stone, however, observes, in answer to a letter of inquiry: "Mr. Mulhatten's story about the newly discovered cave near Leitchfield, Ky., is an utter hoax, and I never heard anything about the matter until I saw it in print!"

The public is indebted to the same inventive brain for the hoax that went the rounds in 1878, about the "Grand Crystal Cave," near Glasgow, Ky., along whose wide roads a carriage and span might be driven for eleven miles, and whose deep rivers were navigable for steamboats for fourteen miles! A letter from Mr. Kelly, the proprietor of this cave, after expressing indignation at these exaggerations, states that it is only three miles long, and has no rivers nor roads, "though," as he adds, "there is room for a great many wagons to turn around, if they were once in there!"

## Gold and Silver in the Sub-Treasury.

A change in the office of assistant treasurer makes necessary the counting of the deposits of gold and silver in the Sub-Treasury. The work of weighing and counting will occupy a number of officers, assisted by thirteen clerks, for the space of three weeks The amount of silver to be handled is worth $26,000,000 and weigh about 800 tons. There are, besides, 114 tons of gold, valued at $57,000,000; and $5,000,000 in notes, silver certificates, and other securities. The capacity of the storage vaults is overstrained.

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## RECENT INVENTIONS.

An improved vegetable and plant cutter and harvester has been patented by Mr. Robert T. Pettebone, of Wyoming, Pa. The invention consists of a bowl or scoop adapted to contain the head of a plant when cut, which scoop is provided in front with a V-shaped recess having cutting edges to sever the stem of the plant and cause the latter to fall in the bowl. The bowl has a handle at rear.

Billiard and pool tables have been provided with conductors placed within the frame for conveying the balls from the several pockets to a common receptacle. These conductors are applied during the manufacture of the table, and cannot be put in a table of ordinary form without considerable mutilation, besides which, the conductors not being accessible, there is difficulty in removing the balls in case of stoppage, and the attendant cannot remove the balls until they reach the receptacle, as is sometimes desirable in order to save time. Mr. Patrick Ryan, of New York city, has patented an improved attachment, which consists in an open trough applied at the outside of the table in position for receiving the balls, and inclined toward one end of the table for conveying the balls thereto, the device being readily applicable to any pool table, and giving access to the balls throughout its whole length.

An improved cover for sap buckets and other vessels has been patented by Mr. Charles D. Reynolds, of Revere, Mass. The invention consists in constructing a cover with an arched elastic projection and a downwardly projecting rim, whereby the cover can be applied to vessels of different size and will be kept securely in place.

An improved spring-board wagon has been patented by Messrs. Henry F. Stearns and William F. Bidwell, of Glens Falls, N. Y. In this invention the under sides of the spring boards are provided with torsion springs, which are arranged to exert their force upwardly against the middle portion of the spring boards, so as to arch the same and promote their elasticity, strength, and safety.

An improved breech mechanism that can be readily applied to muzzle-loading guns without requiring special tools or skill, has been patented by Mr. David B. Duncan, of New Richmond, O. The invention consists in a two-part breech block fitted in a recess of the gun barrel, so as to be swung upward and slide backward in opening the breech.

An improvement in butter packages has been patented by Mr. Edward Hayward, of Frewsburg, N. Y. The object of this invention is to provide butter, oyster, sugar, and similar packages having means by which the lids are securely held in place upon the packages, and by which the packages may be hermetically sealed, so that the handling of such packages is greatly facilitated.

An improved coke furnace and feeding apparatus has been patented by Mr. Richard Thomas, of Carbondale, Ill. The object of this improvement is to provide for the convenient charging of coke furnaces, removal of coke, and the subsequent handling of the same. For this purpose the inventor combines with the furnaces tramways provided with a winding engine and cars, elevators for receiving and elevating the coke, and use scrapers of novel form.

An improved adjustable instrument for planing and smoothing the edges of soles of boots and shoes has been patented by Mr. Charles A. Kilpatrick, of Athens (Orcut Creek P. O.), Pa. The invention consists in a handle with a bend or knee in the middle, and provided at this bend and on the under side with a curved knife and a gauge adjustable in the direction of the length of the handle. A sliding gauge, moving at right angles to the length of the handle, is held on the side by a screw.

Messrs. Otto F. Oeters and Frederich W. Stute, of St. Louis, Mo., have patented an automatic feed for vinegar generators, in which the generator is supplied at regular intervals with regular quantities of the wash or material undergoing fermentation.

A novel apparatus for filtering and cooling waster has been patented by Mr. Robert H. Franklin, of Guadalajara, Mexico. The object of this invention is to furnish a portable and effective apparatus for family and hotel use by which a supply of filtered and cool water can be kept on hand for use as required. The invention consists in a water receptacle constructed of filtering material, and in the combination therewith of a vessel of porous material, in which the water is cooled by evaporation from the outer surface.

An improvement in loom shuttles has been patented by Mr. Charles T. Pratt, of New Hartford, N. Y. The object of this invention is to prevent blemishes from being woven in cotton cloth. These blemishes are caused by a thread of the warp breaking and becoming snarled in the shed, thereby preventing some of the warp threads from crossing when the shed is changed. Nearly all cotton looms have a stop-motion applied in connection with the filling to stop the loom when the filling breaks or runs out. These devices are for use in connection with such stop-motion to insure the stoppage of the loom when a blemish is being woven.

A new combined seed and fertilizer dropper has been patented by Messrs. Henry E. Brill and Dearborn Emory, of Waverley, O. The main object of this invention is to facilitate the dropping of seed and fertilizers and insure uniformity in the amount dropped.

An improved horse-collar connection has been patented by Mr. Christopher G. Calo, of Albany, N. Y. This collar is light, durable, inexpensive, and of such construction that it can be easily and conveniently placed upon and removed from the horse.

An improved combined frame or stand for receiving furnaces of various sizes and one or more pots, has been patented by Mr. Mathias A. Laska, of New Orleans, La. The invention consists in a metal frame provided with legs and with two sliding grate frames, on which the pots are placed on top, below which grates the furnace is placed on a ring resting on two crossed bars in the lower part of the stand, this ring having a series of notches of various sizes, so that the ring can be adjusted higher or lower, according to the height of the furnace.

The usual method of forming edge seams of articles of clothing is to baste down the turned edges, and then stitch them by machine. Devices have been used to press back the edge on the wrong side of the garment and hold it while being stitched, but the right side of the garment being underneath during the stitching, the shuttle stitch is formed on that side, which is highly objectionable. Mr. Joseph Benjamin, of Brooklyn, N. Y., has patented an improved device for forming the edge and gauging the width of seam while the garment is stitched with the right side upward, as in the hand operation. The invention consists in an attachment provided with a fixed tongue and adjustable gauge.

A sulky plow patented by Mr. Leroy Brown, of Waitsburg, Washington Territory, is an improvement on the construction of the sulky plows for which Letters Patent, Nos. 211,696 and 226,705, were granted to the same inventor, January 28, 1879, and April 20, 1880, respectively. The improvement renders it more substantial, so that it can be more conveniently guided, controlled, and adjusted.

## How Spiders Fly.

BY PROFESSOR C. A. YOUNG.

I was very much interested, a few days ago, in hearing a friend give an account of a manuscript she had seen, which was written by Jonathan Edwards when nine years old. It was an account of the behavior of certain small New England spiders, the manner they fly through the air, and the way to see them best, by getting into the edge of a shadow, and looking toward the sun. It is neatly and carefully written, and illustrated by little drawings, very nicely done. The philosophical tendencies of the young writer already appear, for his conclusion as to the "final cause" of spiders and their flying is this: the little animals are scavengers, and since, in New England, the prevailing winds are west, they are carried to the sea in their flight with whatever filth they have consumed, and so the land is cleansed.

Every one knows how, in sunny weather, the little creatures, standing on their heads, project from their spinnerets fine filaments of gossamer, which are caught by the breeze, and float off into the air, though still attached to the spider. When she perceives that the thread is long enough, and the pull of the wind sufficient, she releases her hold and flies away on her gossamer like a witch on her broomstick; by watching her chance, and letting go only when the breeze is favorable, she is carried to her desired haven. Experiments have been tried by placing the animals on a chip floated in a pail of water. So long as the air was in motion about them they were able very soon to escape from their island; but when a bell glass was placed over the pail, thus preventing air currents, they could not get from the island to the surrounding shore.

But how does it happen that, on setting out for a voyage, the spider almost invariably *ascends* with her web, and continues to rise, until, by pulling in her thread, she reduces her floating power, and so comes down? Spider-web, in and of itself, is not lighter than air: how, then, is its buoyancy to be explained?

In two ways, I think. When the sun is shining, every projecting object, like a twig or stick, absorbs heat more rapidly than the air, becomes warmer than the air, and thus acts like an independent source of heat in generating an ascending current, so that when the spider lets go her hold she and her thread are carried up partly by the action of this current.

But this is not all; unless I am much mistaken, *the action of the sun's rays on the thread itself and its surrounding envelope of air* is the main cause of its buoyancy. Air is nearly diathermanous, or transparent to heat, so that the solar rays, in traversing it, warm it only slightly. The spider's thread is not so, but in the sunshine warms up almost instantly, heating the air in immediate contact with it; and then, although the spider thread alone is heavier than air, yet the thread and the adhering envelope of warmed and expanded air taken together, are lighter than the same bulk of the cooler air around, and thus constitute a quasi-balloon, on which the spider sails away. Of course, if this is so, the poor creatures cannot sail much on cloudy days and I think, in fact, they do not.

I have tried a few experiments to verify the idea, and so far as they go they all confirm it. For instance, one day in the autumn of 1880, when the air was full of floating gossamer, and there was no wind blowing, I caught some of the filaments at the end of a little stick, to see how they would behave. So long as I stood in the sunshine they streamed straight upward, tugging with almost a breaking strain; as soon as I stepped into the shadow of a building, they lost their spirit, and drooped abjectly; the moment I put them in the light again they resumed their buoyancy. It is of course possible that in the shade there were local downward air currents to account for their behavior; but once a cloud passed across the sun, and they drooped then, just as they did behind the building.

The same theory will explain the buoyancy of any minute particles of dust or smoke. So long as the sun shines, they will absorb its rays, become warmer than the air, and surround themselves with a buoyant envelope, which will carry them up, if they are not too heavy in proportion to their surface. But if the air is still and the sun obscured, they will settle down near the earth, in the way we are all familiar with in muggy weather. Of course, if there is much wind, this will mainly control their movements, and neither their buoyancy in sunshine, nor their gravity in shadow, will be particularly noticeable.—*Boston Journal of Chemistry.*

## Gravitation.

The balance has been applied by Herr v. Jolly, at Munich, to the problem of gravitation thus (*Wied. Ann.*, No. 10, *Nature*): The instrument was placed in the upper part of a tower, and from each of the scales depended a wire (through a zinc tube) having a second scale at the lower end, 21·005 m. below. These lower scales were 1·02 m. from the ground, so that a lead ball one meter in diameter might be brought under one of them. A body brought from an upper scale into a lower one has an increase of weight corresponding to its degree of approach to the earth's center and to the increase of acceleration. When the lead ball is brought under the same lower scale its pull is added. The difference of the increments of weight, with and without the lead ball, indicates the amount of pull of the latter, and the quotient of this pull and that of the earth alone furnishes a means (with the law of gravitation) of comparing the density of the earth with that of the lead, and, the latter being known, of determining the mean density of the earth. Referring to the original for details, we merely state that the author finds the mean density 5·692 (probable error not more than ± 0·068). This agrees more or less with other determinations; from the mean of those with the torsion balance it diverges about 2 per cent.

## Iodine Reactions.

The use of iodine as a test for starch is fortunately now well known, and as the dark blue color which this reagent strikes directly it comes in contact with the slightest trace of starch is so marked, the test is one that is readily appreciated even by those inexperienced in chemical operations. There are, however, several precautions necessary in the use of this test: in the first place, the iodine solution must be prepared by dissolving a little iodine in a solution of iodide of potassium, which is a far better solvent than alcohol, as the latter sometimes interferes with the reaction; then the solution to be tested for starch must be cold, for the blue color is destroyed by heat, and on no account must it be alkaline, otherwise the iodine enters into combination, and no longer exists as a free agent. Care should be taken not to add an excess of the iodine solution, for its strong yellow color is liable to neutralize the blue of the starch compound, the resulting green color being far less marked, and less easy to detect, especially when only small quantities of starch occur. When a solution contains dextrine, as well as starch, the latter is not so easy to detect, because the characteristic blue color is masked by the red or brown color struck by the dextrin. In such a case it is well to gradually heat the liquid, for the brown color produced by dextrin is destroyed at lower temperatures than the starch color, and when the latter has also disappeared it will reappear again as the liquid cools, before the brown color of dextrin iodine reappears; in this way we are enabled to detect small quantities of starch in the presence of dextrin.

## Artificial Port Wine.

Dr. Collenette, a Jersey physician of temperance principles, lately gave a lecture on the "Manufacture of Old Crusted Port." One of the audience was requested to purchase from a local wine merchant of repute a bottle of port, for which he paid six shillings. This, with cobwebs, etc., was deposited on the lecturer's table. Dr. Collenette then stated he would, in the course of a few minutes, produce a similar article at a cost of *five farthings*. A judge—a gentleman said to be well qualified—was then elected by the meeting. A committee was chosen to come on to the platform and witness the operation; this consisted of weighing out ingredients. The basis of the composition was cider; bullock's blood was used for a rich tawny color, tartaric acid to give age, cream of tartar mixed with gum water was smeared on the inside of the bottle and gave a beautiful crust. Outside, cowbebs with dust and whitewash were applied to give an ancient look, and the bottle was stoppered with a well-stained cork. The *expert* was introduced, and tasted a glass from each bottle, declaring, with a knowing wink at the audience, that the wine *a la Collenette* was the genuine article; the temperance audience of course applauded to the echo.

## An Extract of Malt.

The analysis of a dry extract of malt manufactured in Dresden, for pharmaceutical purposes, gave the following results:

| | |
|---|---|
| Moisture | 2·02 per cent. |
| Protein substances | 7·02 " " |
| Fatty substance | 0·22 " " |
| Soluble carbohydrates | 88·50 " " |
| Insoluble carbohydrates | 0·42 " " |
| Mineral matter | 1·64 " " |
| Phosphoric acid | 0·55 " " |

This extract occurs as a light powder of a pale yellow color, possessing a pleasant smell and taste; it is slightly soluble in cold water, has an acid reaction, and is very hygroscopic.

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## Business and Personal.

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Malleable and Gray Iron Castings to order, by Capital City Malleable Iron Co., Albany, N. Y.

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Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Send for Pamphlet of Compilation of Tests of Turbine Water Wheels. Barber, Keiser & Co., Allentown, Pa.

List of Machinists in United States and Canada, just compiled; price, $10. A. C. Farley & Co., Philadelphia.

Presses & Dies (fruit cans) Ayar Mach. Wks., Salem, N. J.

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Telegraphic, Electrical, and Telephone Supplies, Telegraph Instruments, Electric Bells, Batteries, Magnets, Wires, Carbons, Zincs, and Electrical Materials of every description. Illustrated catalogue and price list, 72 pages, free to any address. J. H. Bunnell & Co., 112 Liberty St., N. Y.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Abbe Bolt Forging Machines and Palmer Power Hammers a specialty. S. C. Forsaith & Co., Manchester, N. H.

The Sweetland Chuck. See illus. adv., p. 450.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

4 to 40 H. P. Steam Engines. See adv. p. 382.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Skinner's Chuck. Universal, and Eccentric. See p. 449.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

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C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 412.

Ajax Metals for Locomotive Boxes, Journal Bearings, etc. Sold in ingots or castings. See adv., p. 449.

Draughtsman's Sensitive Paper. T. H. McCollin, Phila., Pa.

For Rubber Packing, Soap Stone Packing, Empire Packing, and all kinds, write Greene, Tweed & Co., N. Y.

List 27.—Description of 3,000 new and second-hand Machines, now ready for distribution. Send stamp for same. S. C. Forsaith & Co., Manchester, N. H., and N. Y. city.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor. Stiles & Co., Riegelsville, N. J

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 12.

Common Sense Dry Kiln. Adapted to drying all of material where kiln, etc., drying houses are used. See p. 13.

Peck's Patent Drop Press. See adv., page 30.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Paragon School Desk Extension Slides. See adv. p. 30.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Clark & Heald Machine Co. See adv., p. 413.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

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Supplee Steam Engine. See adv. p. 30.

For the manufacture of metallic shells, cups, ferrules, blanks, and any and all kinds of small press and stamped work in copper, brass, zinc, iron, or tin, address C. J. Godfrey & Son, Union City, Conn. The manufacture of small wares, notions, and novelties in the above line, a specialty. See advertisement on page 28.

Brass & Copper in sheets, wire & blanks. See ad. p. 30.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

New Economizer Portable Engine. See illus. adv. p. 29.

Hand and Power Bolt Cutters, Screw Plates, Taps in great variety. The Pratt & Whitney Co., Hartford, Ct.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Ball's Vari ble Cut-off Engine. See adv., page 30.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Saw Mill Machinery. Stearns Mfg. Co. See p. 29.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 30.

Lightning Screw Plates and Labor-saving Tools, p. 30.

Don't buy a Steam Pump until you have written Valley Machine Co., Easthampton, Mass.

Geiser's Patent Grain Thrasher, Peerless, Portable, and Traction Engine. Geiser Mfg. Co., Waynesboro, Pa.


## Notes & Queries

### HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) J. D. W. asks: What is the cause of steam pipe and fittings corroding and rusting inside? In some cases portions are entirely eaten away until leaks are formed. A. The action noted is attributed to the presence in the steam of much free oxygen and carbonic acid and sometimes sulphites—derived from sulphides present in the water.

(2) W. A. K. asks: 1. How can I transfer a photographic print on glass in order to paint it? A. Try the following: Separate the paper print from the background by steaming it; dry thoroughly, and having given the warmed glass an even coating of clean balsam or negative varnish, place the face of the print on the surface thus prepared, smooth it out, and let it stand in a cool place until the varnish has hardened. Then apply water, and with a soft piece of gum rubber rub off the paper so as to leave the photographic image on the varnished glass. 2. Also, what can I use with sand to make a pavement that will wear equal with brick—the proper quantity given? A. Use hydraulic cement, or cement and water-glass. See "Footwalk Pavements," in SUPPLEMENT, No. 82, and "Water glass," page 16, vol. xlv., SCIENTIFIC AMERICAN.

(3) C. Q. H. asks: 1. How can I purify and clarify beef gall (ox gall) for cleaning and coloring silk, etc.? A. Evaporate the fresh gall to a sirup, and then spread it out in a thin layer on a plate placed near the fire. This is the Pharmacopœia plan, but it takes none of the color out of the substance. It simply desiccates the bile, which can in this condition be preserved from putrefaction for any length of time in stoppered bottles. If fresh ox gall is evaporated on a water bath and then treated with alcohol, the mucus and epithelium are precipitated, but the coloring matter still remains, and is not precipitated or discharged by digesting. Again: boil one pint of fresh ox gall with one ounce of alum, and in another vessel a second pint with one ounce of common salt. After standing three months in separate bottles, the clear portion from these solutions is to be mixed for use. But the solutions do not become altogether clear, although they keep well. Ox gall is thoroughly decolorized by acidulating it slightly with acetic acid and passing through it a stream of chlorine gas. 2. Can you tell us how much coal—how many tons—is annually used in the United States for heating and steam making purposes? A. About sixty million tons per annum.

(4) A. L. asks: Will you please give a receipt for making nitrate of iron? A. Iron (scrap), 5½ pounds; nitric acid, 2 gallons. Put the acid into a six gallon pot (stoneware), and gradually add the iron until the whole quantity has been taken up by the acid. It is best to keep the acid warm while dissolving the iron. Silk spirits or nitro-sulphate of iron, sometimes called nitrate of iron, is prepared as follows: Nitric acid (strong), 2 gallons; copperas (iron sulphate), 24 pounds; put the acid in a stoneware pot in a warm place and gradually introduce the copperas. If the acid cannot be conveniently warmed put in a quart of hot water with the acid.

(5) A. J. M. writes: To prevent a horse from cribbing I covered the feed trough with pieces of rubber such as is used in billiard tables. It has answered the purpose perfectly.

(6) J. V. Q. asks: Is there really such an instrument as a "divining" or "mineral" rod or magnet, by means of which minerals, gold, silver, etc., can be traced in the earth? A. The dipping needle (magnet) is sometimes employed in tracing bodies of magnetic iron ore, but no instrument has yet been devised that has proved of any practical value as a means of prospecting other ores or metals.

(7) B. & B., of O., have in a coal house adjoining a mill 2,000 bushels of slack and nut coal, from which they use 40 bushels per day. The mass is beginning to heat. Is there danger of the coal taking fire? A. Many instances of spontaneous combustion of coal, probably always containing pyrites, are on record. Probably in this case sufficient warning of real danger would be given in the daily inspection.

(8) W. M. B. asks: What are the proportions between iron and copper. If accidentally in contact in a liquid, will a current leave the iron for the copper? A. Iron is more electropositive than copper. When immersed in a liquid conductor and connected by a wire a current of electricity passes from the iron to the copper through the liquid and back again to the iron through the wire.

(9) R. E. M. asks: 1. How to make enough varnish for a violin; some kind that will not be affected by the moisture of the chin? A. See receipt on page 394, answer No. 2, vol. xliv. 2. Are the rivets of large boilers, such as steamboat, railway, etc., hot or cold when they are being riveted? A. Hot.

(10) C. O. N. asks: Can you tell me of some remedy for a watch that has been affected by electricity in visiting the engine room of an electric machine? A. You can demagnetize your watch by placing it in a helix connected with a strong battery or magneto machine, by rapidly reversing the current passing through the coil and at the same time gradually diminishing the strength of the current until it is nil.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. W. B.—The mica is probably worth developing; good sheets would be worth from 25 cents to $2 a pound. See "Mica and its Utilization," page 257, vol. xlv.—W. J. K.—A bituminous substance, probably deposited from an alkaline liquid.

[OFFICIAL.]

## INDEX OF INVENTIONS

FOR WHICH

**Letters Patent of the United States were Granted in the Week Ending**

**December 27, 1881,**

**AND EACH BEARING THAT DATE.**

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Abdominal supporter, E. C. Glinning ... 251,431
Adding machine, D. M. & J. A. Fulwiler ... 251,567
Animal shears, J. A. Ducom ... 251,353
Animal trap, W. Swartz ... 251,388
Annunciator and operating table for telephone lines, C. M. Root ... 251,640
Attrition mill, H. A. Duc, Jr ... 251,535
Automatic gate, Austin & Chamberlain ... 251,498
Baling press, P. K. Dederick ... 251,421
Bar. See Car draw bar.
Barrel cover, J. Lamont ... 251,603
Barrel windlassing machine, J. Greenwood ... 251,575
Basket, folding cotton, G. W. Starr ... 251,651
Bed or mattress supporting frame, F. A. Palmer ... 251,630
Belt, drive, B. H. Stiles ... 251,483
Belting machine, J. Reese ... 251,377
Berth, self-leveling, J. H. Porter ... 251,632
Berth, sleeping car, W. R. Ware ... 251,489
Bicycle, J. Amess ... 251,398
Bit. See Bridle bit.
Bluing paddle, A. E. Spencer ... 251,384
Board. See Dash board.
Boat. See Life boat.
Boiler for domestic purposes, E. P. Bryden ... 251,518
Boiler testing apparatus, S. Rue ... 251,467
Boot and shoe crimping board, C. R. Gibbs ... 251,568
Boot and shoe nailing machine, E. Merritt ... 251,453
Boot strap, G. B. Siegenthaler ... 251,647
Bottle, glass, W. H. Fuller ... 251,566
Bottles, instrument for opening internally stoppered, H. Codd ... 251,525
Box. See Sluice box.
Box fastener, G. L. Jaeger ... 251,592
Box fastener, C. Martell ... 251,449
Box nailing machine, J. H. Swift ... 251,484
Bridle bit, J. A. Fairbanks ... 251,424
Broiler, D. A. Dickinson ... 251,531
Bucket, well, W. T. Hendricks ... 251,586
Buffing machine, J. H. Stevens ... 251,481
Building, J. R. Rhinehart ... 251,637
Burial case, M. Goff ... 251,432
Button hole finishing tool, J. McGuigan ... 251,451
Calipers, G. B. Webb ... 251,662
Cap, P. Goldmann ... 251,572
Carbureting apparatus, G. W. Crowell ... 251,416
Carburetor, W. T. Barry ... 251,673
Car coupling, E. H. Janney ... 251,594
Car coupling, D. Keethler ... 251,366
Car coupling, H. Merz ... 251,619
Car draw bar, railway, A. L. Anderson ... 251,496
Car starter, C. W. Stiff ... 251,386
Car ventilator and air purifier, railway, F. A. Bruns ... 251,407
Car wheel, S. H. Walz ... 251,661
Cars, draught and buffing apparatus for railway, Coulter & Hibbert ... 251,414
Cars, ventilating window for railway, J. M. Forbes ... 251,426
Card, sample, W. A. Laverty ... 251,606
Carpet beating machine, J. Spaulding ... 251,480
Carriage bow top, L. Murray ... 251,626
Carriage jack, H. H. Brundage ... 251,677
Carriage top, L. Schmetzer ... 251,472
Carrier. See Egg and fruit carrier.
Case. See Burial case.
Chair. See Child's chair. Convertible chair. Folding chair.
Chandelier, electric, T. A. Edison ... 251,553
Chandelier, extension, J. T. Bruen ... 251,516
Chandelier hook, C. Maschmeyer ... 251,613
Child's chair, seesaw, wagon, and swing, combined, T. C. Keeler ... 251,601
Chisel, mortising A. E. Rowley ... 251,641
Cigar bunch press, E. Toman ... 251,3 90
Clay crusher and separator, Wallace & Kramer ... 251,660
Cleaner. See Stove pipe cleaner.
Clock escapement, C. Reinhardt ... 251,379
Clock movement, W. E. Doolittle ... 251,532
Clock movement, A. E. Hotchkiss ... 251,363
Clock pendulums, suspending, H. H. Ham, Jr. ... 251,360
Cockeye and clip, C. L. Lewis ... 251,369
Collar pad, horse, F. F. Kanne ... 251,600
Coloring matter or dyestuff, H. Baum (r) ... 9,986, 9,987
Colter, plow, A. J. Kersh ... 251,602
Conductor, underground, T. A. Edison ... 251,552
Convertible chair, B. C. Wilson ... 251,396
Cooker, feed, J. W. Gilmore ... 251,356
Cooking apparatus, steam, D. Grove ... 251,578
Cooling or congealing liquids and separating crystals therefrom, process of and apparatus for, W. Bell ... 251,512
Cork drawing machine, A. Muir ... 251,455
Cornice, curtain, G. Baldwin ... 251,503
Corset, M. Adler ... 251,493
Coupling. See Car coupling. Thill coupling. Thill and pole coupling.
Crusher. See Clay crusher. Grain crusher.
Cuff holder, F. Bain ... 251,502
Cultivator, A. Creech ... 251,527
Cultivator, A. Tschop ... 251,656
Cut-off, T. Clark ... 251,350
Cutter. See Thread cutter.
Dash board, A. Z. Boda ... 251,514
Dental bit holder, H. C. Register ... 251,461
Dentist's broach, O. Johanson ... 251,598
Die. See Screw cutting die.
Door check, G. W. Winters ... 251,491
Door spring, P. K. O'Lally ... 251,457
Dovetail tonguing and grooving machine, F. Chichester ... 251,349
Dredging machine, C. J. Allen ... 251,495
Dress fitting, adjustable support for persons during, C. F. Bartlett ... 251,507
Drier. See Fruit drier. Grain drier.
Drop light, electrical, T. A. Edison ... 251,559
Easel, telescoping, A. Herzog ... 251,438
Egg and fruit carrier, J. J. McIntire ... 251,617
Electric light, T. A. Edison ... 251,538
Electric lighting, system of, T. A. Edison ... 251,542, 251,551
Electric machine, dynamo, T. A. Edison ... 251,537
Electric machines, regulator for dynamo, T. A. Edison ... 251,555
Electric machines, regulator for magneto or dynamo, T. A. Edison ... 251,556
Electric meter, T. A. Edison ... 251,545
Electrical generation and distribution, system of, H. S. Maxim ... 251,450
Electrical governor, T. A. Edison ... 251,547
Electro-magnetic motor, T. A. Edison ... 251,541
Elevator. See Water elevator.
Embroidering and apparatus therefor, method of, J. Halter ... 251,579
Embroidery machine, E. Ross ... 251,381
End gate, wagon, S. D. Davis ... 251,530
Evaporator, J. C. Gunn ... 251,433
Fan, fly, T. A. Martin ... 251,612
Fanning mill, I. M. Hutches ... 251,443
Fare register and recorder, N. A. Ransom ... 251,634
Fence, barbed, G. E. Barker ... 251,505
Fence, portable, J. Giger ... 251,569
Fertilizing compound, E. J. Houser ... 251,364
Filtering liquids, apparatus for, J. B. Moore ... 251,624
Fire extinguishing apparatus, H. S. Maxim ... 251,614
Flour packers, attachment to, J. P. Ward ... 251,392
Flux, H. Glass ... 251,570
Folding chair, E. J. Smith ... 261,478
Frame. See Bed or mattress supporting frame. Pocketbook frame. Roving frame.
Fruit drier, R. E. Burns ... 251,408
Fuel and process of manufacturing the same, G. S. Page ... 251,458
Furnace, H. R. Taylor ... 251,485
Gas pressure regulator, R. F. Hatfield ... 251,436
Gate. See Automatic gate. End gate.
Generator. See Steam generator.
Glove fastener, W. D. Thompson ... 251,655
Glove fastening, A. Bottger ... 251,515
Glove, husking, J. F. Glidden ... 251,571
Grain crusher, J. & R. Reid (r) ... 9,992
Grain drier, E. Louis ... 251,372
Grater, nutmeg, A. E. Francis ... 251,427
Grinding and amalgamating pan, F. A. Huntington ... 251,442
Grindstone tool holder, G. G. & B. D. Bayha ... 251,510
Guano, manufacture of fish, G. B. Oakes ... 251,628
Guard. See Pendulum guard. Railway stock guard.
Gun, magazine, A. F. Bellinger ... 251,344
Hair, treating hog, J. Lippincott ... 251,446
Halter for horses, E. Barnard ... 251,506
Hammock and frame, portable covered, N. Vizelich ... 251,488
Handle. See Tinware handle.
Harrow, J. W. & S. H. Cawley ... 251,411
Harrow, M. Daley ... 251,418
Harrow, E. W. Herendeen ... 251,587
Harvester binder, S. D. Locke ... 251,447
Harvester finger, C. J. Johnson ... 251,595
Hat sizing and scalding machine, J. R. Russell ... 251,470
Hats, beating up machine for making napped, J. R. Russell ... 251,471
Hats, machine for sticking naps on felted, J. R. Russell ... 251,469
Hay knife, H. O. Turner (r) ... 9,991
Headlight, C. T. Ham ... 251,680
Hinge, automatic gate, W. Hull ... 251,589
Hinge, spring, G. L. Jaeger ... 251,591
Hog nose trimmer, S. & F. Lane ... 251,604
Holder. See Cuff holder. Dental bit holder Grindstone tool holder. Lead and crayon holder. Rein holder. Sash holder.
Hook. See Chandelier hook.
Horseshoe, G. H. Reynolds ... 251,636
Horseshoe nail blanks, manufacture of, G. W. Miller ... 251,454
Indicator. See Station indicator.
Indigo blue, manufacture of soluble derivatives of, A. Baeyer ... 251,501
Indigo, manufacture of artificial, A. Baeyer ... 251,499, 251,500
Indigo, preparation of new material for the manufacture of artificial, A. Baeyer ... 251,671
Inking pad, R. H. Smith ... 251,383
Insulated cables, manufacture of covered wire for, H. A. Clark (r) ... 9,989

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Insulated material, machine for covering wire with, H. A. Clark (r) ... 9,988
Insulating composition or compound for coating electric and other wires or conductors, F. W. Schroeder ... 251,473, 251,474
Jack. See Carriage jack. Railway track jack.
Jar. See Slop jar.
Joint. See Railway rail joint.
Knife. See Hay knife. Mincing knife.
Lamp or socket and holder, electric, T. A. Edison. 251,554
Lamp and the manufacture thereof, electric, T. A. Edison ... 251,549
Lamp, electric, T. A. Edison ... 251,539, 251,543. 251,546
Lamp, electric, R. A. Johnston ... 251,599
Lamp, incandescent electric, T. A. Edison ... 251,548
Lamp socket or holder, electric, E. H. Johnson ... 251,596
Lamps, carbon for electric, T. A. Edison ... 251,540
Lamps, manufacture of electric, T. A. Edison ... 251,544
Lantern, D. C. Baughman ... 251,509
Lard, refining and hardening, W. Ohara ... 251,629
Lasting machine, C. W. Glidden ... 251,430
Lasting machine, G. McKay ... 251,452
Lasting machine, Thompson & Mower ... 251,487
Lead and crayon holder, P. Schrag ... 251,646
Leader hooks, machine for making, I. N. Doremus 251,423
Leather blacking, coloring, and dressing machine, F. B. Batchelder ... 251,401
Lever, compound, J. & N. Hiatt ... 251,681
Life boat, W. Lockerby ... 251,611
Light. See Drop light. Electric light. Headlight.
Link bending machine, L. Acheson ... 251,397
Loom harness, mechanism for depressing, H. M. Farr ... 251,564
Loom swivel rack, B. Weston ... 251,664
Magneto-electric machine, A. E. Briggs (r) ... 9,993
Magneto or dynamo-electric machine, T. A. Edison ... 251,550
Mail pouch fastener, R. H. Hewitt ... 251,361
Manure, etc., apparatus for gathering and loading, E. B. & D. S. White ... 251,394
Matches, manufacture of friction, L. Wagner ... 251,391
Mattress, wire, A. W. Stewart ... 251,482
Metal articles, ornamenting and protecting, E. R. Cahoone *et al.* ... 251,409
Metallic fastener, G. W. McGill ... 251,616
Meter. See Electric meter. Webermeter.
Milk pan cover, D. J. Davis ... 251,420
Mill. See Attrition mill. Fanning mill.
Mincing knife, M. R. Reeves ... 251,378
Mitten, I. A. Robinson ... 251,682
Moulding machine, J. Anderson ... 251,497
Motion device for converting, F. Elbing ... 251,560
Motor. See Electro-magnetic motor.
Mowing machine, E. Smith ... 251,479
Mowing machine, A. Telfer ... 251,389
Net, fly, J. A. Stiteler ... 251,653
Nose ring, P. Drais ... 251,533
Nozzle, spray, P. Long *et al.* ... 251,448
Oiler locomotive, Brooks & Bowen ... 251,436
Organs, expression bellows for, Evans & Jarrett. 251,562
Ovens, pole rest for annealing, N. Granger ... 251,573
Pad. See Collar pad. Inking pad.
Pail dinner, H. Huth ... 251,444
Paint for roofs, etc., A. E. Brockett ... 251,676
Pan. See Grinding and amalgamating pan.
Pantaloons, W. W. Beach ... 251,511
Paper bag machine, A. Beyer ... 251,402
Paper pulp, etc., and the apparatus therefor, manufacturing human and other figures by moulding them from, F. F. Bastier ... 251,508
Paper pulp machine for pressing and finishing hollow articles from, W. J. Keefe ... 251,365
Paper with celluloid and other materials, waterproofing, W. B. Carpenter ... 251,410
Pendulum, adjusting, J. F. Lash ... 251,368
Pendulum guard, H. Slusher ... 251,648
Piano action, upright, I. Bullard ... 251,348
Pianoforte, upright, J. Hardman ... 251,581
Pills, lozenges, etc., machine for the manufacture of compressed, J. H. Gill ... 251,678
Pipe connection, F. Holt ... 251,441
Pipe drawing apparatus, P. Patterson ... 251,459
Planter, corn, N. O. Starks ... 251,650
Plow, J. König ... 251,445
Plow, D. Lindahl ... 251,370
Plow, roller, C. F. Goddard ... 251,357
Plow, steam, B. S. Benson ... 251,513
Pneumatic dispatch apparatus, G. W. Storer ... 251,654
Pocketbook, M. F. Langfeld ... 251,605
Pocketbook frame, C. Scherer ... 251,645
Power from steam engines or other motors, transmitting, H. A. Jamieson ... 251,593
Press. See Baling press. Cigar bunch press.
Pressure regulator for fermented liquids, W. R. Freeman ... 251,428
Printing press and other machinery, R. W. Taylor 251,486
Processing apparatus, Nicodemus & Weeks ... 251,456
Pulley balancing apparatus, W. Hetherington ... 251,439
Pulley, self-lubricating loose, C. W. Wilder ... 251,666
Pump, W. L. Chipley ... 251,523
Pump, J. T. Coleman ... 251,413
Pump, J. Harris ... 251,582
Pump for air, gases, etc., compressing, S. D. Lount 251,373
Pump piston, C. M. Hanson ... 251,580
Pump, vacuum, T. A. Edison ... 251,536
Rack. See Loom swivel rack.
Railway brakes, valve arrangement for pneumatic, G. Westinghouse, Jr. ... 251,490
Railway rail joint, R. L. McConnell ... 251,375
Railway rails, bending, R. Fagan ... 251,563
Railway stock guard, T. F. Davidson ... 251,419
Railway switch, M. R. Dahlgren ... 251,417
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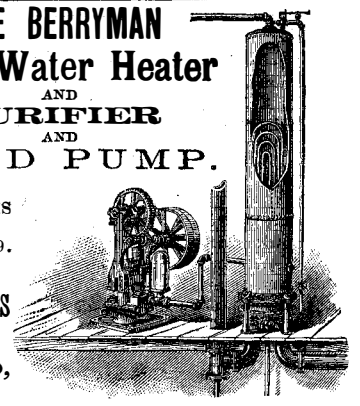

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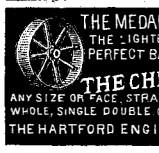
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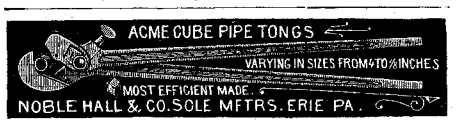



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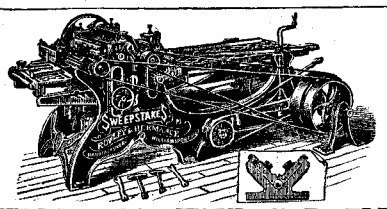

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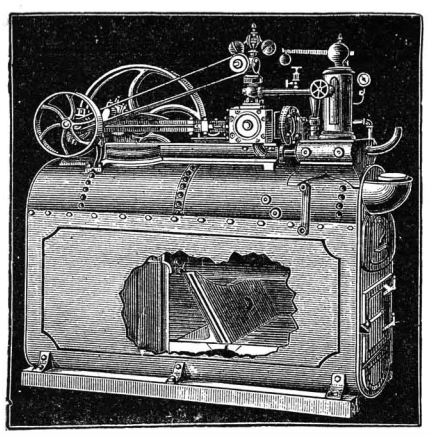

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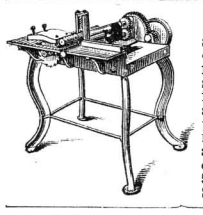

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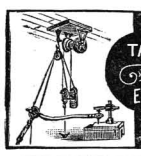

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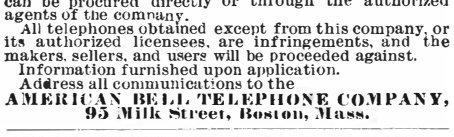


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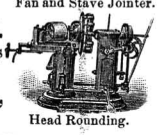


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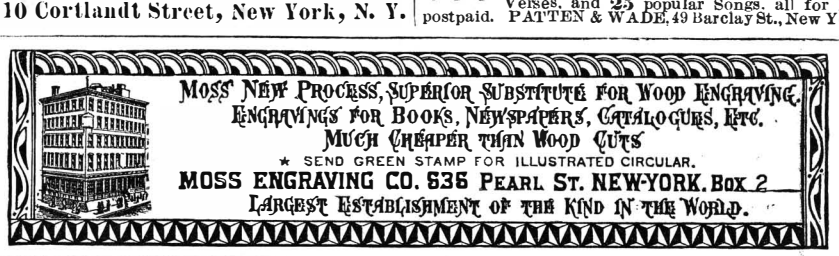
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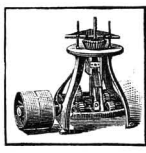

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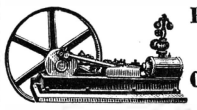

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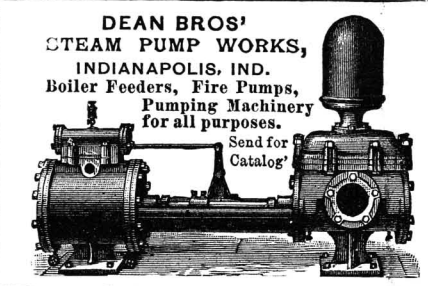

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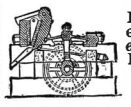

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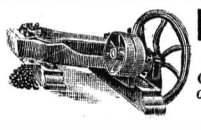

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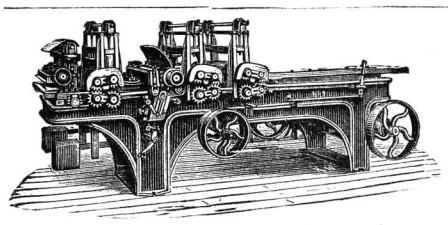

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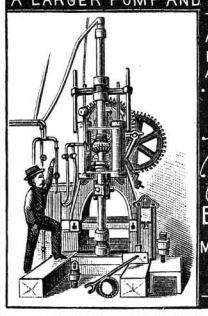

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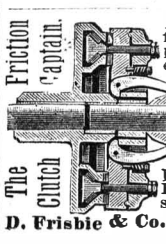


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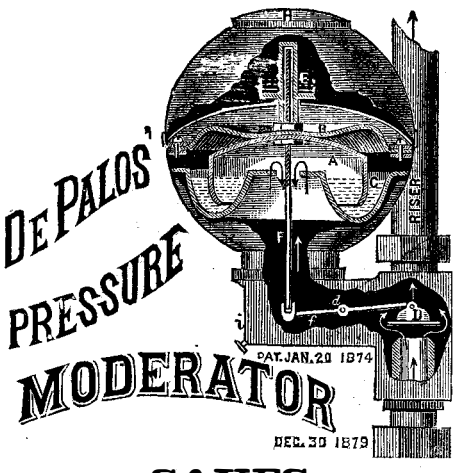


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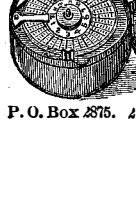

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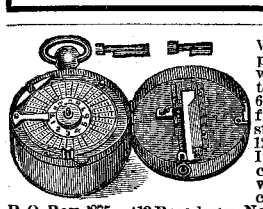

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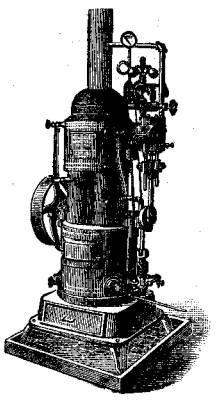

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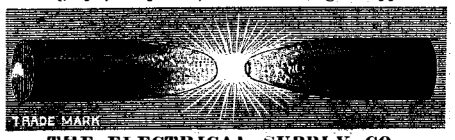


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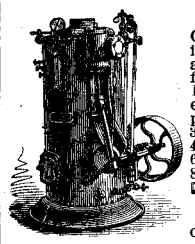

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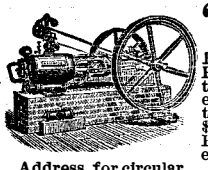

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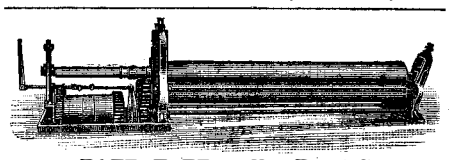

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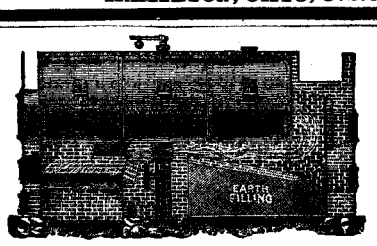


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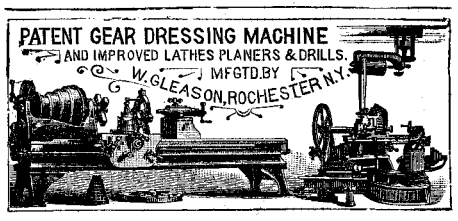


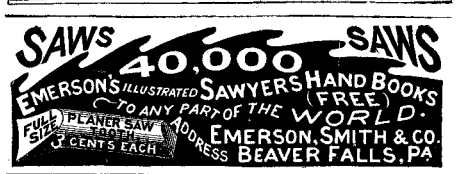


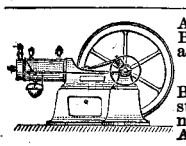

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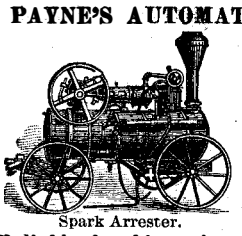

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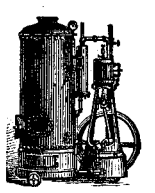

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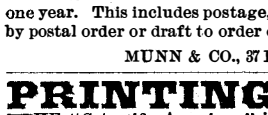

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